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SEPTEMBER 29, 1987**END SUBDIRECTORY
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Garry Ray, *PC Week* ”

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Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

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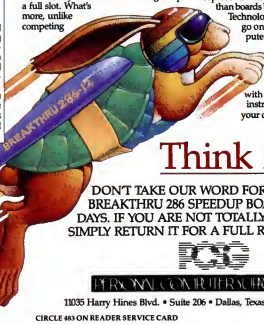
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CIRCLE 483 ON READER SERVICE CARD

■ STEPHEN MANES

page MK-7A-2 of the manual.

Merg decides to try printing his document. Alas, the Quasimodo codes are not 100 percent compatible with his Itzibitzi printer. When the ribbon forcibly ejects

into his proboscis, Mergenthaler flings the book and disks across the room, wailing "Disimprovement!"

Mergenthaler's been down the old disimprovement trail before, and so, we'll

wager, have you. By now, disimprovement is a standard feature that comes with virtually every upgrade or enhancement, no extra charge, no need to send in the registration card. Often it amounts to an omission nobody bothered to notice. Sometimes it's more sinister.



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CIRCLE 106 ON READER SERVICE CARD

ENHANCEMENT PENALTIES IBM pioneered deliberate disimprovement with its original PC keyboard—the one that screwed up the classic Selectric layout in the interest of protecting Displaywriter sales as long as salesmenly possible. However, IBM's "Enhanced" keyboard seems to be a model of accidental (pronounced "stupid") disimprovement. In adding features that probably should have been included all along, it manages to muck up the placement of just about every major shift and function key.

"Enhancement" often comes with speed and/or size penalties. Nice modest programs designed to run fine on 256K systems suddenly require every last byte you can give them, plus expanded memory if you don't want to wait 2 weeks every time you perform an insertion. Programs that once fit on a single floppy now come on 18 and demand two-thirds of your hard disk. Programs that once ran like greased lightning now run like congealed bacon drippings. What possessed IBM to include a sluggish hard disk as a mandatory feature of its otherwise hot PS/2 Model 50, for example, is best left to interpreters of entrails.

FIGHTERS Particularly maddening are changes with no apparent purpose. The original Hayes outboard Smartmodem 1200 included a useful switch to let the modem ignore one of the RS-232 cable's lines; some of Hayes's "fully compatible" inboard modems left it out. The deviant aspects of Release 2 of 1-2-3 created a cadre of users who fought rather than switched.

No one's advocating stagnation. Something may well have to give when you add a slew of features to a program or a machine. But perhaps certain hardware and software designers should memorize the classic maxim that begins, "If it ain't broke . . ."—or would that give us a keyboard with AINTBROKE replacing QWERTYUIOP?

■ STEPHEN MANES

DISIMPROVEMENT: ONE STEP FORWARD, ONE STUMBLE BACK



Could "If it ain't broke, fix it anyway," be the favorite maxim of hardware and software designers? Did you survive your last "upgrade" with temper and sanity intact?

It's here: the long-awaited Release 7 of *Duzitall*, the integrated word-processing spreadsheet, database, pie-chart baker, and now desktop publisher. "New!" proclaims the cover. "1,734 new features!"

Mergenthaler has used *Duzitall* since its humble beginnings. He has read the four-page Day-Glo ads. He knows that Release 7 is purported to be a veritable Santa Claus of wish-fulfillment. With eager digits, he rips open the box and slaps the installation disk in Drive A.

Moments later, he sees an enlightening message: Installation Failure. Merg's hard disk wasn't close to full before, but now it's got just 3 measly bytes free. The manual informs him that the new version of *Duzitall* requires 2.5 megabytes of disk space; the old one fit in a mere 360K.

Well, the disk needed a good mopping-up anyhow. Half an hour later, Merg is ready to try the installation again. This time it proceeds flawlessly—except that when he's asked to pick his printer from a list, he can't find his ancient Itzibitzi anywhere. Weird, thinks Merg: *Duzitall* has supported the Itzibitzi faithfully since Release 1.

After paging through every one of the manual's 34 references to printers, he stumbles upon the Xeroxed addendum. "Note: Certain printer options available in previous releases are no longer supported. If your printer is unlisted, install for one that employs similar commands. Or choose 'Generic' and use DUZIT, our new programming language, to customize further."

Merg doesn't know a thing about programming, but he vaguely recalls one printer that's supposedly compatible with his Itzibitzi. He selects the Quasimodo B-52 and finishes the installation. Then he types DUZ and presses the Enter key. "Not enough memory," replies the screen.

AN ALMOST-EASY FIX Huh? The old version ran with room to spare along with half a dozen memory-resident programs. Oh. The manual says the new version insists on 448K and "strongly recommends" a minimum of 512K. Well, okay; Release 7 can do macros, so the old keyboard enhancer can go. So can the phone dialer, since Release 7 includes communications. And maybe the calculator, notepad, and calendar can bite the dust. A few changes to AUTOEXEC.BAT, a reboot, the magic letters DUZ, and voilà!

Merg presses F5 to open an old file. The

machine beeps. F1 Help tells him to press F5 and type in the filename he wants—just as he did. Then Merg remembers reading something about file incompatibility. Back to the manual.

Ten minutes later, Merg has learned that *Duzitall* 7 won't accept files produced with any earlier version. But it's almost easy to fix them. Merg masters the special key combination Shift-F5, Alt-7, Ctrl-Ins, Gray Plus, Ctrl-NumLock to shell out to DOS. Then all he has to do is type CONVERT, the filename, and six asterisks to signify *Duzitall* 6 format. In less than 5 minutes, he is back in the program with his file at the ready.

Whoa! What are those eighth notes at the end of each paragraph and those happy faces between each word? F1 doesn't Help. The manual does. A mere Alt-F3, End, &, !, Alt-Home later, all the codes have vanished from the screen.

Now to work. Just for fun, Merg moves to the bottom of his document. It does go faster than the old version. He scrolls backward. He's not positive, but it seems rather sluggish. He presses Alt-B to mark the beginning of a block. The cursor goes crazy.

NOT 100 PERCENT COMPATIBLE

Then he remembers: that keystroke combination worked only with his keyboard enhancer—which he can't run anymore. Merg presses F1 for info on macros. He follows what ought to be the right method for creating an Alt-B macro, but all he gets is a bunch of beeps. "Macros may not be initiated by Alt-key combinations," states



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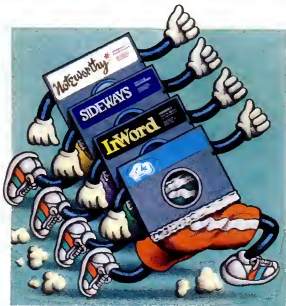
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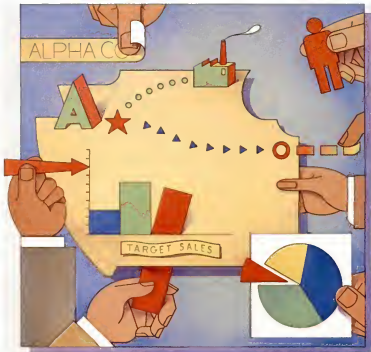
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CIRCLE 479 ON READER SERVICE CARD

PC MAGAZINE ■ SEPTEMBER 29, 1987

■ JIM SEYMOUR

WHAT QUALIFIES AS GREAT SOFTWARE?



Picking winners from the raft of software introduced each year forces us to put them into categories. Outside those classifications, however, are some real gems.

What makes for great software? I've been thinking about that a lot lately, asking PC users and mavens for their definitions. What I've learned is that our old answers don't work anymore.

Conventional wisdom holds that great software is fast, smart, as nearly intuitive as possible, and useful for so many people that it's likely to be a big seller.

Those criteria have produced acclaim for what have become generally acknowledged as the "great" programs so far in the PC business: certainly *1-2-3*, probably *Javelin*, arguably *R-base* and *Paradox*, maybe *XyWrite*, *WordPerfect*, and *Microsoft Word*.

Notice how quickly I fell into the trap of grouping programs by application category? First the spreadsheets and near-spreadsheets, then database managers, then word processors. If I thought there was any broad consensus about graphics programs and communications software, I'd probably have added them, too.

It's just that kind of category-focused thinking that blinds us to some superb programs—software arguably "great" by the modern-day misuse of that word.

LOST IN THE GULF The problem lies not in those criteria—software *should* be fast, smart, and so on—but in the way we organize programs into categories, then look within those categories for winners and losers. Over here there are all those Big Five Applications packages that come so readily to mind, and over there, on the other side of a vast gulf, there are all those

obscure and uninteresting vertical applications, such as vacuum-cleaner repair management packages.

What we overlook are programs lost in that wide gulf between the two. We ignore the possibility that these programs doing time in a kind of Faustian purgatory, between the heaven of horizontal-software glory and the obscure hell of the vertical market, may well qualify as "great" software for many users. And we assume that because these transitional programs don't fit into our categories, they're never going to be big sellers or primary applications for many users.

What stirred these thoughts was a new program called *ACT!*, which I first saw a couple of months ago. I was predisposed to dismiss it, because of something a friend who manages a large office for one of the Big Eight accounting firms had said.

An enthusiastic *ACT!* user, he said he thought it would become the primary PC

application for everyone in his office. C'mon: an office full of accountants where *1-2-3* wasn't the primary tool? Don't put me on.

He persisted, and I eventually opened the box and ran the program.

I have a quick "sniff test" for good software. I watch for programs that, as they unfold on-screen, turn out to be designed just the way *I'd* do them. Don't you react the same way? When you see a program that finally does it *your* way, aren't you impressed?

ACT! was even better than that; it was far better than I'd do. So I started working with it. And two months later, I think it's a great program.

What is this wonder? Without a nice, neat label (categories do have their uses), the best I can do is say that it's a combination contact-manager and daily schedule-keeper.

ACT! lets you construct two screens of partly user-definable information about your business contacts. You can flip between them with one keystroke. You can capture in those screens names, addresses, telephone numbers, secretary's and spouse's names, and so forth. Other fields carry such useful information as the last time you talked to the person, what you discussed, when your next contact is due, how many times you've called, and how many times you've actually gotten through. As far as possible, the program fills in these fields for you—snatching the date from the system clock, for example.

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■ JOHN C. DVORAK

INSIDE TRACK

Rampant IBM rumors fill the airways.

Rumors of the mysterious PS/2 Model 90 are hotter than ever. Reports have it that the machine will be the much-awaited link to the minicomputer world and will even have still another bus design—an **enhanced Micro Channel**. Perhaps the new bus will also find its way into the next generation of IBM minicomputer, possibly dubbed the System/39.

The kicker to the Model 90 is that the prototype has **dual processors**. One is a fast 20-MHz 80386 and the other a new version of the **IBM RISC chip**. The IBMers call it a Sun-Killer. Sun Microsystems recently introduced a 10-MIPS RISC machine into the minicomputer workstation market. The Model 90 will have to be as fast to be competitive. Supposedly the Model 90 runs UNIX and a crude version of OS/2 and some sort of in-house-developed VM operating system (popular on mainframes). One guy saw it running **all the operating systems at the same time in individual windows**. "It was a screamer," he said.

The old IBM RT is a dead issue. Don't expect to hear anything about it by this time next year.

New things expected from the company and perhaps shipped with the Model 90 include a superset of the VGA adapter called the **E-VGA for extended VGA**. The color palette will be extended to 16.7 million colors, 1,024 displayable.

Look for this baby the first part of next year. Price, \$15,000 for openers.

Meanwhile, IBM is readying its much-rumored **Convertible Plus**—the 80286 version of its laptop that we all expected to see a couple of months ago when IBM instead showed us the Convertible Model III, which was the same old machine with a beefy power supply

and a backlit screen. The Model III marks the second time IBM has upgraded the screen. The question is "where are all the old screens?" What do people do with them? Our senior tech editor Robert L. Hummel suggests people use them to make **large LCD clocks for the wall**. Large, unreadable LCD clocks.

The name for the new machine hasn't been finalized. Some are calling it the Convertible/2; others say it will be the Convertible Plus. It will contain a new in-house-design IBM 3½-inch hard disk, and it will run DOS 3.5! Yes, three point five. It will be an OS that will incorporate drivers for a new line of weird-sized hard disks that IBM is readying for release. One is something like **133 megabytes** and will sell for a premium of only \$999 or so more than a 20- or 30-megabyte disk drive.

DOS 3.4 is expected to be introduced in the interim and supposedly is just DOS 3.3 with bug fixes. I expect to see DOS 3.4 in September and the Convertible Plus in November or later.

These new disk drives, incidentally, are supposed to use some RLL or other fancy dancing to improve their performance. The word on the street is that both Sony and Fujitsu intend to **announce cheap, high-performance disk drives** that use special compression techniques built into the controller that turn a plain-vanilla, sluggish 20-megabyte drive into a 35-megabyte screamer. Their target audience is the cloners. Expect to hear more before year end.


The Japanese are readying a few other surprises for the gringos. More and more I hear about **breakthrough laser printers** to be shown at the November Comdex. Six hundred dots is ready to roll and look for 300 dots for \$1,300 or less.

More importantly, there is a concerted effort by a group of Japanese printer makers to **clone completely the PostScript system that Adobe Software licenses**, and which may account for as much as \$500 of the price you pay for a PostScript laser printer. The license is too expensive and the royalties cost too much, think too many cost-conscious Japanese. Bring out the programmers!

What's happening is that laser printer makers realize the **benefits of PostScript**, which is a fabulous page description language without peer. The problem is that it's not optimized for speed, still can't do some things it's supposed to do, and most importantly, costs one large arm and a medium leg to license. Clone it. It should be easy enough because it has no look and no feel.

The Laugh's on IBM Dept.: Take a look at the cheap Model 30 turned into a typewriter, and you'll find a Model 30 without slots selling for about \$700 less than a real Model 30. You can buy them from IBM typewriter dealers. The motherboard still has the traces for the slots, and anyone who can plug in a soldering iron can solder in some slots in a few minutes for a few bucks. Word is out about this **lowball upgrade**; the memos are flying. The typewriter guys think it's great. Regular PC dealers are irked.

Second gag: I noticed that at a recent PC Magazine Editor's Day the local computer company that rents machines has used **Krazy Glue to affix the removable key caps** to the keys of the PS/2 machines. My gag was to switch the pause and escape keys. Nobody ever knows where the escape key is on an IBM anyway.

Finally: Have you seen the 5¼-inch IBM add-on disk drive for the new machines? **What a monster!** It has to be the biggest 5¼-inch drive case ever made. Who is IBM kidding with stuff like this? 



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CIRCLE 245 ON READER SERVICE CARD

■ JOHN C. DVORAK

IT WORKS, OR ELSE!

Why should users be stuck paying for software that doesn't work on their systems? It's time for hardware and software vendors to start carrying the burden.



Incompatibility, memory-resident feuds, inadequate testing, and copy-protection schemes are causing system crashes like there's no tomorrow. The result is the creation of a flock of sheepish novice computer users and a horde of angry power users. The problem is now so bad that all software and hardware vendors should offer a money-back guarantee on all their products.

This problem came home to roost this week as I tried a series of software packages on various clones and compatibles. I ran into problems.

My recent exploit started with a superb utility called *MicroHelp* from a company of the same name (2220 Carlyle Dr., Marietta, GA 30062; (404) 973-9272). It's a memory-resident program that sells for \$59 and claims to boost display speed, recall old commands, and allow you to scroll back your screen to read stuff that flowed off the top (a very handy thing). This is an excellent program and I wish I could recommend it, but I can't.

Unfortunately, like a lot of other programs, it's arrogant and assumes that it will not conflict with anything else in terms of two programs using the same keystroke to activate a function. With *MicroHelp*, to read the scroll buffer (the stuff that scrolled off the screen) you hit the PgUp key. This is the same button used in the popular *ProComm* communications program to upload a file. If you hit it in *ProComm*, you get the upload message instead of the scroll-back buffer. Worse, the program doesn't let you reprogram the keys so you can change the command.

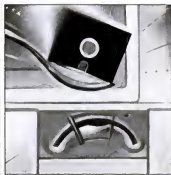
Programmability of the keys so that you can change command "hot keys" is critical for programs like this. Developers, take note.

MEMORY-RESIDENT ROULETTE

The other problem I had, which I suspect is universal, is that I have many of these memory-resident programs in my machine at any time. I use a cache, an on-line thesaurus, stuff like that. I had to juggle around the load position of the *MicroHelp* program to get it to fit into memory without conflicting with something else and crashing the system. In other words, I had to try to load it at different points in the loading queue to get it to work.

This need for experimentation when running memory-resident programs is a big bore. I'm sick of it.

Next I start to play with *Chuck Yeager's Advanced Flight Simulator* from Electronic Arts. It supposedly runs on compatibles.



It won't run on a Tandon XT with a Hercules Plus card or on a Samsung AT with a Video 7 EGA Plus card. So what will it run on? I gave up on it.

Now *Marble Madness*, another Electronic Arts game, ran fine on the Samsung AT. *Yeager* was a mystery. It could have been any number of things. It's simply not worth the trouble to figure it out. You'd think the company would have some compatibility guidelines for its programmers so that if one program worked, then they all would work.

What's happened is that because of individuality and those who cater to individuality, we have managed to create personal computer systems that are pushed beyond their design capabilities. The attitude is that if we can put together a wacky system that works, then great. Too bad something comes along once in a while that refuses to run on the thing.

The big headaches are experienced by the vendors who cannot duplicate all the possibilities to make sure a program can run on, say, a Taiwan clone with a bootleg Phoenix BIOS, a PC-Kwik cache, an expanded Cheetah memory, a Fansi Console, a Paradise EGA, and five miscellaneous utilities in RAM. It boggles the mind. I doubt OS/2 will improve things.

The long-term problem is that buyers will balk at trying new software. The business may be doomed by this reluctance. That's unless all vendors offer a money-back guarantee for all their programs. If it doesn't run right, you get your money back—no questions asked. It's the only solution.

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**EDITOR'S SCREEN**

against BASIC. A paucity of libraries, debuggers, and other tools only adds to the problem. About the only good thing you could say about BASIC was that it generally supported the PC's hardware before any other language. Of course, it's easy to use, but the resultant debugged-one-line-at-a-time spaghetti code is universally derided.

Manufacturers have addressed the problem by making high-level languages cheaper, better, and more accessible. The new generation of BASIC compilers has judicious extensions. They make it possible to write clean, well-structured code. They support the hardware as well as or better than the interpreter. The resulting compiled programs are robust and run fast. You don't have to apologize for programming in BASIC anymore.

Pascal is another story. Just when it was about to be consigned to a dusty, fusty corner of academia's toolbox, Borland International saved it from oblivion, single-handedly. Now Turbo Pascal has a life of its own, and it has spawned a whole new generation of programmers. They love it for its speed, structure, and simplicity. Our Power User column has been thick with Turbo tips for years. Now we've given them a new home.

ONE-STOP SHOPPING You might ask, "Why *PC Magazine*? Isn't there a bunch of magazines that cover this stuff?"

Not really. Do you like reading incomprehensible diatribes about the way the 68020 is really better than the 80386? Me neither. Do you think the Sieve of Eratosthenes is a fairly useless benchmark? Me too. Mandelbrot sets are a marvelous mathematical mastication, but when was the last time you used them in one of your programs?

We think the same way you do: if it doesn't help you work faster, better, and smarter, it's not worth putting in the magazine. Besides, we've got something that no other magazine can match: PC Labs and the review-packed features section. *PC Magazine* is big. Our readers tell us that they don't want to read other magazines. They have enough to do already. So in order to keep them happy we have to make it better.

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NEVER SAY NEVER



The computer industry is changing rapidly. The needs of users are in constant flux. So we're launching three new columns and Machrone eats crow.

“We’re never going to have a column on C in *PC Magazine*.”

“Never?”

“Nope. Never.”

I had to eat those words. And I was so sure, too. Three issues from now, we’re starting a column on systems programming and its two major languages, C and assembler. It’ll be authored by none other than Ray Duncan. You may remember Ray as the author of “The Right to Assemble,” his enormously popular column in the late, lamented *Softalk* magazine. Ray also has a number of books to his credit and is the editor of the heavily revised, soon-to-be-released *Microsoft DOS Encyclopedia*.

Meanwhile, systems-level programming is bigger than ever. We’ve been publishing assembler programs for years—those quick little patches and utilities for which it would be overkill to write a whole program. Each machine, after all, comes with a bare-bones assembler: the A instruction in Debug.

The advent of sub-\$100 C compilers has changed the face of systems programming. In addition, new operating systems expect to be called from high-level languages, not from assembler programs. Duncan’s column is a recognition of those changing realities. Also, C is a subtle language. Beneath its elegant simplicity is a world of hurt and trouble if you misuse it. We hope to help raise the proficiency of the new generation of C users that will inevitably spring up with the advent of these high-performance, low-cost compilers.

THE BIG LAUNCH But we didn’t stop there. In this issue we’re launching two new technical columns. First is *Environments*, by Charles Petzold. It is a clearing-house for issues and answers on OS/2, Presentation Manager (including *Windows*), and 80386 control programs. You probably fondly remember Petzold’s landmark articles on expanded and extended memory, enhanced graphics adapters, hi-res monitors, and other topics. Readers extol his direct, clear style and exceptional ability to explain difficult technical concepts in simple terms.

Our other new column is *Languages*, edited by Robert Hummel. Rob is our multilingual senior technical editor, who will be ably assisted by Neil Rubenking and Ethan Winer. Rubenking is a Pascal expert and the author of the popular shareware program, *Pianoman*. Winer lives, eats, and breathes BASIC. He’s a consultant and professional programmer, and also the

author of a package of BASIC utilities. Both have written numerous articles for *PC Magazine*. The focus of *Languages* is applications and techniques. It’s yet another forum for reader interaction, a place where power users show what they know and beginners get a fast hand up the ladder. *Languages* will focus primarily on BASIC and Pascal, but we’ll gladly accept power tips on any language.

How did these changes come about? Mostly through the continuing demands of our readers. We gauge those demands four ways: through letters to the editor, the *PC Magazine Interactive Reader Service*, submissions to existing technical columns, and interactions at user group meetings. All four pointed to a much higher interest level in languages.

It shouldn’t be any surprise. With 10 million PCs out there, the raw number of programmers has increased proportionally. And despite their incredible gains in power and performance, standard applications programs still sometimes fall short of users’ needs and expectations. Only a programmer can address those needs.

At the same time, thousands of businesspeople who wouldn’t use the word *programmer* to describe their jobs are programmers. They program in self-defense. It’s a straight extension of the reason they got a PC in the first place: they couldn’t get the job done any other way. So there’s nothing to do but leap into the breach.

Every PC comes with BASIC, but the language has languished under a cloud of ill repute. Slowness, dearth of structure, and lack of robustness are all valid charges



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* Using the suite of 48 comprehensive benchmarks published in Data Based Advisor, March 1987.

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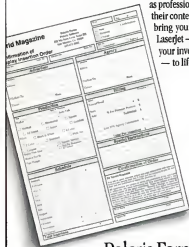
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A large, stylized, red cursive word "Lucid" is written diagonally across the right side of the page. It has a soft grey shadow cast to its left, giving it a three-dimensional appearance.

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COMMUNIQUÉS

edited by Bill Howard

Amazing Facts I

"WordStar 2000 is a trademark of Microsoft Corporation."

—Novell Netware 286 user manual

Amazing Facts II

"Vance Gass and six co-inventors at International Business Machines Corp. in Austin were awarded a patent last week for a program called DisplayWrite."

—Austin (Tex.) American Statesman, June 13, 1987

No Respect

"A computer, valued at \$10,000, a programmer, valued at \$1,000, and three power drills were reported missing."

—Delaware County Times, June 2, 1987



Maybe the dog ate it? The Commodore computer on the cover of this CompuServe brochure doesn't have a modem or modem cable attached.

Classified Intelligence

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—The Boston Globe, May 31, 1987

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—Ad for Access Turbo PC

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—Rockford (Ill.) Register Star, May 4, 1987

As Punishment, He Gets Free Access To the Police Department Computer?

A 16-year-old boy in China, Maine, programmed his PC to dial every phone number in town in the middle of the night. The boy's mother said the youth believed "the system would only connect through if there was a . . . modem at the other end." Instead, he woke up 800 residents.

Earlier, he ran up a \$5,000 long-distance bill dialing into other systems ("he figured night rates are very low," the mother said).

The unidentified boy was ordered to perform 60 hours of community service—entering data into the police computer system.

—Concord, N.H., Monitor, May 13, 1987

COMPUTERIZED FUR STORAGE



Don't you worry the hairs might get sucked into the cooling fan?

(Abraham & Strauss ad. The New York Times, May 14, 1987)

Bring your fur to the A&S nearest you for twelve months of insured cold storage in our temperature and humidity controlled vaults. Plus, if you like, we'll treat your fur to Deluxe Fur Cleaning. We also do expert skinning.



Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to *Communiqué's*, PC Magazine, One Park Avenue, New York, NY 10016, or MCI Mail 157-9301. Contributors receive \$50 and a PC Magazine T-shirt. In case of duplicate entries, the earliest postmark prevails. Sorry, but entries can't be acknowledged. Please include the name and issue date of any newspaper/magazine clippings. And please, don't send classified ads for sloppy drives, leather quality printers, or cereal interfaces.

Winners this issue: Richard Kulmann (CompuServe), Eugene Scanlon (\$1,000 programmer), Dave Bushong (800 wake-up calls), David Evans (Nouvelle Network), Ralph Flanders (Access PC), Karen Pasky (friendly guinea pig), Steve Offner (Microsoft WordStar), Jim Seymour (DisplayWrite patent).

Peachtree Complete Accounting for Just \$199

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Everyone's Asking How Can We Do It?

When you reduce the price of an 8-package accounting system from \$4,800 (or \$600 a module) to \$199 for the complete set, people are bound to ask questions. Here are some of the most popular ones we're hearing at Peachtree:

Q. How can we afford to sell Peachtree Complete at such a low price?

A. We've reduced our costs without reducing product features. Peachtree Complete has been repackaged into one set that includes more thorough and better organized user instructions. We've also streamlined order processing and reduced overhead. It is faster and easier to buy our product.

Peachtree has long been the first name in accounting software, so we've had time to completely amortize our original development costs plus make over 100 major additions. These enhancements include multi-company capability, menu driven installation and removal of copy protection. Consequently, you're getting a proven product at a better price.

We also "unbundled" support (so you only pay for what you need when calling our toll-free technical support hotline) and established a network of local dealers to serve as Independent Peachtree Support Centers.

Q. What does Peachtree Complete include?

A. 1. Eight Integrated Software Modules:

- General Ledger • Accounts Receivable • Sales Invoicing • Accounts Payable
- Inventory Control • Fixed Assets • Job Cost • Payroll

2. An Installation Guide to lead you step by step through our simple installation procedure.

3. An Accounting Primer, written for Peachtree users by an industry expert, to explain accounting concepts.

4. Tutorials on each module with sample data to make learning easier.

5. A complete Reference Library with detailed instructions in plain English on all software functions.

Q. Is Peachtree Complete really the same product that used to sell for \$600 per module?

A. Peachtree Complete is basically the same accounting system that both Peachtree and IBM sold for about \$5,000 but with substantial improvements in function and presentation.

With more than 150,000 users to its credit, Peachtree Complete has been the PC World Class Winner in its category for two of the last three years.

Q. What's the difference between Peachtree Complete and the \$69.95 systems?

A. Peachtree's system is called Complete because it contains the eight most needed accounting packages (including payroll) and all reference materials for one price. Remember, it was designed as a \$4,800

accounting software system.

The \$69.95 systems, on the other hand, are incomplete. They were designed to sell for \$69.95 and require the purchase of additional modules to be comparable—payroll, \$49.95 more; tutorials, \$19.95 each; etc. Everything is a la carte.

Q. How soon will I outgrow the system?

A. Peachtree Complete handles revenues up to \$21,000,000, so only the largest companies will outgrow the system. The ability to process data for an unlimited number of companies is one of the system's biggest selling points.

An optional multi-user module soon to be available allows Peachtree Complete to be installed in a Local Area Network. And Peachtree Data Query, for just \$199, lets you quickly transfer your accounting data

to many popular spreadsheets and databases, as well as produce custom reports.

Q. What if I'm not satisfied with Peachtree Complete?

A. When you purchase Peachtree Complete directly from Peachtree Software, you're protected with a **60-Day Money Back Guarantee** (an option even the most expensive accounting products don't offer).

If you're not satisfied, simply return the complete product in saleable condition within 30 days and your purchase price will be promptly refunded.*

InfoWorld Report Card

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manuals...We rate Peachtree's Complete Business Accounting System an excellent value."

—Richard Morochov, InfoWorld Review Board.

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WINNER 1986
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OF THE
YEAR

What if you had to push a button to see those little yellow notes on your paperwork? That would be crazy! And yet, every competing note program expects you to push a button to look for notes on your screen. Think about that. You need to remember to look for reminders. Only SmartNotes Version 2 has automatic note pop-up.

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notes to 1-2-3 database records. And conditional notes that pop up only if a test is satisfied. And compatibility with other Lotus add-on programs. *There is simply no better way to annotate 1-2-3 worksheets.*

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QUICK LOOKS

FormTool 2.01 Crafts Customized Forms



HANDS ON

BY MITT JONES

Looking for a way to make that new laser printer earn its keep? Ditch those expensive, special-order business forms and pick up a copy of *FormTool*. This latest version of the popular forms generator from BLOC Development Corp. gives you the features you need to produce high-quality, low-price forms.

You couldn't ask for a better-looking program design. An appealing use of color (if you have it) makes the package a pleasure to learn and use, and the screen layout as a whole is informative and attractive.

FormTool gives you several ways to draw forms. At the most basic level, you can draw man-



You issue *FormTool* commands via keyboard combinations or one of two menus.

ually, trailing a line behind the cursor as you move it about the screen. More often than not, I used the easy-to-remember line-

drawing function-key commands.

Unlike many competitors, *FormTool* automatically joins

intersecting lines into right angles, or Ts, rather than requiring a joining command.

You fill out forms by typing directly into areas you've marked for fill-in, by merging data from a *FormTool* list file, or by merging data from a .DBF, .DIF, or ASCII file. An ingenious linking procedure makes loading .DBF files into *FormTool* list files a breeze.

BLOC Development is bundling *FormTool's Greatest Hits*—a variety of predesigned forms—with *FormTool* at no extra cost until year's end.

List Price: *FormTool*, Version 2.01, \$95; *FormTool's Greatest Hits*, \$29. **Requires:** 256K RAM, two disk drives, DOS 2.1 or later. Not copy protected. BLOC Development Corp., 1301 Dade Blvd., Miami, FL 33139-9990; (800) 231-1149.

CIRCLE 422 ON READER SERVICE CARD

Putting Your WordPerfect On a Leash



HANDS ON

BY EDWARD MENDELSON

MousePerfect is a mouse driver that tricks *WordPerfect* into thinking it was designed to be used with a mouse all along.

With *MousePerfect's* product installed, *WordPerfect* uses all its normal keyboard commands for entering text. But when you start to review and edit your work, the mouse lets you scurry through files and manipulate text more easily than you could at the keyboard. *MousePerfect* lets you perform block operations—normally the most awkward feature of *WordPerfect*—through efficient and intuitive movements. It provides precision cursor control and, unlike many mouse driv-

ers, never lets the mouse take you places where you don't want to go.

MousePerfect gives access to all of *WordPerfect's* functions from its main menu, so you can forget about the keyboard template. An installation program lets you change the cursor speed as you become more adept at mouse maneuvers. It also adjusts the program for different features of *WordPerfect*, Versions 4.1 and 4.2. You can uninstall the driver at any time.

Many mouse manufacturers (although not Microsoft) throw in primitive drivers for *WordPerfect*. *MousePerfect* is different. It's precise, elegant, and perfectly integrated with the program itself.

List Price: *MousePerfect*, Version 2.02, \$30. **Requires:** Microsoft-compatible mouse such as LogiMouse and PC Mouse, *WordPerfect*, Version 4.1 or 4.2. Not copy protected. *MousePerfect* Inc., P.O. Box 367, Clarkston, GA 30021; (800) 628-2828, ext. 564.

CIRCLE 424 ON READER SERVICE CARD

Do-It-Yourself E-Mail



HANDS ON

BY BARBARA KRASNOFF

PC-TelePost, from Coker Electronics, is an elegantly simple communications program that will help you set up an electronic mail system with little fuss or bother.

The program is so automated that after you have specified which text or binary files you wish to send and when, you can leave it alone. Once invoked, *PC-TelePost* goes first to its main menu, waits a couple of minutes for any commands, and then passes to automatic send/receive mode. A Mailbox screen, which is visible while the program is waiting for calls, shows all files that have been received or sent or are scheduled to be sent at a later time.

When you're ready to transmit a file, the program walks you through a series of fill-in-the-blank choices, including the filename, the time you wish the

message to be sent (which can be chosen from a menu or specified by the user), and the name of the recipient(s) and the sender. The recipient can be an individual or a distribution mailing list, and is either chosen from an on-line phone directory or typed in directly. You can also specify an Access ID (for security) and a Subject. *PC-TelePost* will check itself every 5 minutes to see if any messages are scheduled to be sent.

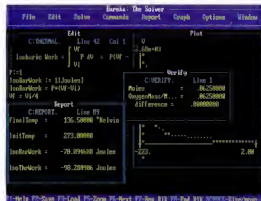
Of course, many communications packages today come with the ability to automatically send and receive mail. But if your company needs a good, fast e-mail system, it would be a pity to ignore such an efficient and inexpensive product.

List Price: *PC-TelePost*, \$75. **Requires:** 256K RAM, one disk drive. Hayes-compatible modem, DOS 2.0 or later. Not copy protected. Coker Electronics, San Mateo, CA 94402; (415) 573-5515.

CIRCLE 425 ON READER SERVICE CARD

How Eureka: The Solver instantly solves equations that used to keep you up all night

The state-of-the-art answer to any of your scientific, engineering, financial, algebraic, trigonometric, or calculus equations = Eureka: The Solver™



Eureka instantly solved this Physics equation by immediately calculating how much work is required to compress isobarically 2 grams of Oxygen initially at STP to 1/4 its original volume. In Science, Engineering, Finance and any application involving equations, Eureka gives you the right answer, right now!

Eureka can solve most equations that you're likely to meet. So you can take a mathematical sabbatical.

Most problems that can be expressed as linear or non-linear equations can be solved with Eureka. Eureka also handles maximization and minimization, plots functions, generates reports, and saves you an enormous amount of time.

Eureka instantly solves equations that would've made the ancient Greek mathematicians tear their hair out by the square roots—and it's all yours for only \$167.00.

Minimum system requirements: For the IBM PS/2- and the IBM and Compaq families of personal computers and all 100% compatibles: PC-DOS (MS-DOS) 2.0 and later, 384K.

Eureka: The Solver is a trademark of Borland International, Inc.
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B-1145

It's easy to use Eureka: The Solver

1. Enter your equation into the full-screen editor
2. Select the "Solve" command
3. Look at the answer
4. You're done

You can then tell Eureka to

- Evaluate your solution
- Plot a graph
- Generate a report, then send the output to your printer, disk file or screen
- Or all of the above

You can key in:

- ✓ A formula or formulas
- ✓ A series of equations—and solve for all variables
- ✓ Constraints (like X has to be < or = 2)
- ✓ A function to plot
- ✓ Unit conversions
- ✓ Maximization and minimization problems
- ✓ Interest Rate/Present Value calculations
- ✓ Variables we call "What happens?," like "What happens if I change this variable to 21 and that variable to 27?"

“Merely difficult problems Eureka solved virtually instantaneously; the almost impossible took a few seconds.

Stephen Randy Davis,
PC Magazine”

Eureka: The Solver includes

- ✓ A full-screen editor
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- ✓ Context-sensitive Help
- ✓ On-screen calculator
- ✓ Automatic 8087 math co-processor chip support
- ✓ Powerful financial functions
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- ✓ Ability to generate reports complete with plots and lists
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In Canada: (800) 237-1136

CIRCLE 137 ON READER SERVICE CARD

PC UPDATE

edited by Peggy Gavan

**IBM PC
Convertible
Model 3**

IBM Corp. has replaced the supertwist LCD screen on the **PC Convertible** for a second time. The third display for the laptop is backlit and can be easily read in dark areas. The original **PC Convertible Model 1** and **Model 2** can be outfitted with the new screen and a more



IBM's new backlit LCD for the **PC Convertible** snaps onto existing models

powerful power supply for \$350. Because of the higher power demand, the **Model 3** has a battery-recharge life of about 4 hours, instead of the 7 on the **Models 1** and **2**. Retail price of the **Model 3** is \$1,695; IBM has cut the price of the **Model 2** to \$1,395.

Toshiba T3100

Toshiba America has announced a new program that allows the owners of the **T3100** portable computer to upgrade their machines from a 10-megabyte to a 20-megabyte hard disk. The upgrade price, which includes installation, a new disk controller, and an updated BIOS, is \$780. To schedule purchase and installation, customers should call Toshiba America at (415) 786-9007.

**Okidata
Microline
Dot Matrix
Printers**

Okidata has dropped the prices on five of its dot matrix printers. The **Microline 192 Plus** is now \$449, down from \$499, and the **Microline 193 Plus** is \$649, a reduction of \$100. Prices on the **Microline 292, 293, and 294** were cut by \$100, to \$300. Okidata, Mount Laurel, N.J.; (609) 235-2600.

MathPlan

WordPerfect Corp. has changed the name of **MathPlan** to **PlanPerfect**. The new version, priced at \$395, has increased calculation speed and the ability to convert worksheets to **WordPerfect**, Versions 4.1 and 4.2. The update costs \$15 for registered users. WordPerfect Corp., Orem, Utah; (801) 227-4000.

**Backup
Master
Version 2.2**

Backup Master, Version 2.2, features a new high-speed backup program, enhanced error correction techniques, and a preview display. Registered users of **Backup Master** can upgrade to Version 2.2, priced at \$89.95, by sending \$13.50 and a copy of their original disk label to Intersecting Concepts, Thousand Oaks, Calif.; (805) 373-3900.

**SmartKey 5.2,
SmartPrint**

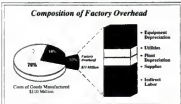
SmartKey, Version 5.2, has several new enhancements, including conditional and context-sensitive macros and pop-up custom bar menus. The new version, priced at \$69.95, is being bundled with the **SmartPrint** printer macro program, usually priced at \$29.95. Registered users can upgrade for \$20. Software Research Technology, Los Angeles, Calif.; (213) 737-7663.

Easy Word II

Easy Word II, priced at \$49.95, has replaced the **Easy Word** word processor. The new release includes windowing, macro processing, and a 90,000-word dictionary. Registered users can update for \$19.95. Dac Software, Dallas, Tex.; (214) 458-0038.

**Microsoft
Chart 3.0**

Microsoft Chart, Version 3.0, adds enhanced image control, new analytical tools, LAN support, and built-in mouse support. Included with these new features are three-dimensional effects for bar, column, line, and pie charts, and



Microsoft Chart, Version 3.0, adds enhanced image control, featuring 3-D effects for bar, column, line, and pie charts.

increased statistical capabilities. Version 3.0 is priced at \$395; upgrades are \$75 for registered users. Microsoft Corp., Redmond, Wash.; (206) 882-8080.

IN BRIEF:

Quadram Corp. has lowered the price of its **Micrafazer V1** six-port printer shaver by \$300, to \$695. Quadram Corp., Norcross, Ga.; (404) 923-6666. . . . Salinon has slashed the prices on **Namer** and **Headliner** by up to \$300. The programs, originally priced at \$295 and \$495, respectively, now cost \$99 each. Salinon, Dallas, Tex.; (800) 722-0054.

by Jonathan Matzkin

Univation Harnesses the Power of 80386 For the LifeServer Network File Server

The speed and 32-bit data-crunching power of 80386 PCs make them ideal for use as file servers in demanding network environments. Univation has introduced the LifeServer 386, a 16-MHz, 80386 file server that Univation sells with its LifeNet local area network operating system.

The LifeServer 386 is supplied with eight PC-compatible expansion slots—two 32-bit, five 16-bit, and one 8-bit. The \$4,600 basic system unit (including networking software)

also comes with one serial and one parallel port. With 75 megabytes of hard disk storage, the system sells for \$10,595. With 150 megabytes, suggested list price is \$14,195. The system can support two floppy disk drives, a tape backup, and two hard disk drives. The LifeServer 386 is compatible with Univation's LifeLink Ethernet cards and UPC/IP software, which provides TCP/IP protocols.

Univation says its LifeNet LAN operating system combines file server and database server software and processes index files at the network server, instead of at individual workstations. This rescues traffic on the network, improves response time, and accommodates more users with no adverse impact on performance, according to Univation.

List Price: The LifeServer 386 with LifeNet network operating system software, \$4,600, with 75 megabytes of hard disk storage, \$10,595; with 150 megabytes, \$14,195. Univation Inc., 1231 California Circle, Milpitas, CA 95035; (408) 263-1200.

CIRCLE 431 ON READER SERVICE CARD



Univation's LifeServer 386 brings the power of the 80386 microprocessor to a network file server.

MatchMaker Links PC To External Disk Drive For Apple Macintosh

It won't make the PC and the Mac into buddies, but the \$149 MatchMaker, from MicroSolutions Computer Products, will interface an IBM PC with a standard external Macintosh disk drive.

You can display the directory of a Mac floppy disk on a PC, copy files to and from the disk, view a Mac text file, initialize blank disks in Macintosh format, and delete files.

The MatchMaker software senses the type of Macintosh

floppy disk inserted and supports both single- and double-sided floppy disks. Subdirectories (folders) are supported in hierarchical file system disks.

The Matchmaker add-in card fits into a half-size PC expansion slot.

List Price: MatchMaker, \$149.

Requires: 192K RAM, external Macintosh disk drive with cable, half-size expansion slot, DOS 2.0 or later. Software not copy protected. MicroSolutions Computer Products, 132 W. Lincoln Hwy., DeKalb, IL 60115; (815) 756-3411.

CIRCLE 432 ON READER SERVICE CARD

Add-in Board Expands Memory of Laserjet II And Canon's LBP-811

Add-in memory for the Hewlett-Packard Laserjet II printer is now available from Pacific Data Products. The expandable 1-2-4 memory board (\$295 without memory) fits into the Laserjet II's expansion slot.

The board accepts either 256K-bit or 1-megabit chips and can be configured with up to 4 megabytes of expansion mem-

ory. Boards can be upgraded at any time, up to the 4-megabyte memory limit. Pacific Data Products also sells a line of memory boards for the Canon LBP-811 laser printer.

List Price: 1-2-4 board for Laserjet II without RAM, \$295; with 1 Mbyte RAM, \$395; with 2 Mbytes, \$895; with 4 Mbytes, \$1,595. Pacific Data Products, 8525 Arjons Dr., Suite M, San Diego, CA 92126; (619) 549-0922.

CIRCLE 435 ON READER SERVICE CARD

HOT PROSPECT

New Line of 386 PCs Breaks Through 16-MHz Barrier and Features Phoenix BIOS

The 80386 clock speed derby has officially started. Advanced Logic Research has introduced the first 20-MHz, 386 PCs, which may leave 16-MHz 386 machines choking in the dust. IBM's 20-MHz Model 80 is due out later this year.

Four basic configurations will be sold. The \$2,495 ALR 386/220 Model 10 includes 1 megabyte of 80-nanosecond, 32-bit RAM, expandable to 2 megabytes on the motherboard. A 1.2-megabyte floppy disk drive is included, in addition to serial and parallel ports. The system has eight expansion slots and a 101-key keyboard.

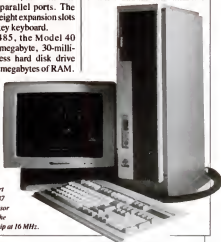
At \$4,485, the Model 40 adds a 40-megabyte, 30-millisecond-access hard disk drive and a full 2 megabytes of RAM.

EMS and EEMS software is provided, along with 32-bit disk caching and Vdisk programs. The \$5,185 Model 80 has a 70-megabyte hard disk drive, and the top-of-the-line Model 130 packs a 130-megabyte hard disk drive.

List Price: ALR 386/220 Model 10, \$2,495; Model 40, \$4,485; Model 80, \$5,185; Model 130, \$7,794. Advanced Logic Research Inc., 10 Chrysler, Irvine, CA 92718; (714) 581-6770.

CIRCLE 420 ON READER SERVICE CARD

Advanced Logic Research has introduced a line of 80386 PCs running at 20 MHz. The systems support either the 80287 math coprocessor at 10 MHz or the 80387 math chip at 16 MHz.



NEW ON THE MARKET

Leading Edge Hardware Poised for Move Into the 80286 PC Arena with Model D2

Leading Edge Hardware Products was one of the first to provide a low-cost, high-quality, and truly compatible alternative to the Big Blue PC. Now Leading Edge has announced that its long-awaited 80286 PC will be available to complement its popular Model D.

The Model D2 has an 80286 processor running at 6, 8, and 10 MHz. It costs \$1,495 with a single 1.2-megabyte floppy disk drive, and \$1,995 in a 30-megabyte hard disk configuration. A floppy disk drive controller is built into the motherboard and

supports 360K-byte and 1.2-megabyte 5¼-inch disk drives, as well as 720K-byte 3½-inch microfloppy drives. The system comes standard with 640K bytes of RAM, which can be expanded to 1 megabyte.

The Model D2's automatic mode-switching graphics adapter supports EGA, CGA, MDA,

and Hercules monochrome graphics standards. The system comes with serial and parallel ports and a battery-backed-up clock/calendar. The expansion bus has six IBM PC-compatible slots. A 200-watt power supply is standard.

Its "positive-click" keyboard was a distinguishing feature of the original Model D, and the Model D2 offers the same feel in an updated 101-key layout. The D2 comes with a 12-inch (diagonally measured) monochrome monitor.

Leading Edge offers its new removable hard disk system as an option. The half-height disk drive (\$995 when sold separately, including two disk cartridges) uses Bernoulli technology to read and write to 20-megabyte disk cartridges.

List Price: Model D2, \$1,495; with 30-Mbyte hard disk, \$1,995. Leading Edge Hardware Products Inc., 225 Turnpike St., Canton, MA 02021; (800) USA-LEAD.

CIRCLE 430 ON READER SERVICE CARD

Leading Edge's Model D2 is a complete 30-megabyte 286 PC with monitor and monochrome graphics capability for \$1,995.



The 575 Vertistack Printer Stand allows desk placement of a printer without any loss of desk space.

Going Mobile: Adapter For Portable III Runs Off Automobile Battery

The Compaq Portable III blows away most other portables, but it's hobbled by its limiting power cord. The \$295 AdaptaIII battery adapter, from Product R&D Corp., allows the Portable III to run off a car battery. You simply plug the AdaptaIII into a cigarette lighter receptacle and into the AC power socket of the Portable III.

For completely portable applications, the company sells a rechargeable battery pack. List Price: AdaptaIII, \$295. Requires: Compaq Portable III and either car cigarette lighter receptacle or battery pack. Product R&D Corp., 1194 Pacific St., #201, San Luis Obispo, CA 93401; (805) 546-9713.

CIRCLE 434 ON READER SERVICE CARD



The \$295 AdaptaIII gives Compaq Portable III users some freedom from AC power outlets. The adapter allows use of a car cigarette lighter as a power source.

Vector's Novel Printer Stand Frees Up Desk And Organizes Cables

With desk space at a premium in most offices, the 575 Vertistack Printer Stand, from Vector, could prove useful. The stand can sit on top of an IBM PC and holds an 80-column printer in a vertical, small-footprint arrangement.

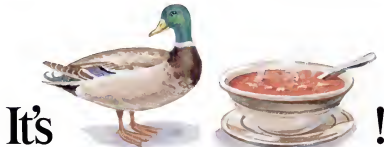
All popular 80-column printers will fit, Vector says.

Slots in the shelves and base of the stand accommodate printer paper, power cords, and computer cables. The printer stand can be mounted over a computer's monitor or off the side of a desk, or fastened to a wall or partition.

List Price: Vertistack Printer Stand, \$75. Vector, 50 Airport Pkwy., #64, San Jose, CA 95110; (408) 947-4621.

CIRCLE 433 ON READER SERVICE CARD

What's it like to tap the power of the *new* Primavera Project Planner?



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We didn't sacrifice capability. In fact, we
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and cost control are easier
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CIRCLE 187 ON READER SERVICE CARD



Disk Optimizer™ puts the zip back into your hard disk.

Your hard disk will run faster when it's not chasing around after files.

Remember the old days when your hard drive was new? Remember that smooth, fast, slick performance? Those quick retrievals, rapid saves, lightning-like database sorts?

Well ever since, DOS has been doing its best to slow your hard drive down. Not by slowing down the motor, but by breaking your files up into pieces. Storing different chunks in different places. Data files, programs, overlays and batches that started out in one seamless piece are now scattered all over.

Loading is slower.

Sorting is slower.

Retrieving, backing-up.

Everything takes longer because your disk has to work harder.

Problem is, it's something that happens so gradually you may not notice the difference. At least, not until you see the dramatic improvement after using Disk Optimizer.

File fragmentation—It's a problem you can see.

Watch your hard drive the next time it reads or writes a file. Each "blip" of the LED means the drive-head is moving to another place on the disk—either to pick up or lay down another chunk of data.

And the truth is, head movement takes time. Far more time than actual reading and writing. What's worse, all this head movement causes extra wear and tear that can shorten the life of your drive.

Disk Optimizer—Tunes up your disk by cleaning up your files.

Disk Optimizer works by finding all the scattered pieces of your files and putting them

back together where they belong. Next time your drive reads it, there's just one place to look.

And the results are often dramatic. Reading and writing times may be cut by as much as two thirds. Database sorts that used to take hundreds of head moves now proceed quickly and efficiently. And since head movement is now at an absolute minimum, your disk drive will lead a longer, more productive life.

Analyze, scrutinize, optimize.

Before you optimize, you'll probably want to analyze. So Disk Optimizer shows you, in percentages, how much fragmentation has taken place—on the

entire disk, in individual directories, or for groups of files you specify using global or wildcard names.

Plus, there's built-in data security that lets you assign passwords to as many files or file groups as you want.

And the File Peeker gives you an inside look at the structure of files. It's a great way for non-programmers to learn more about computers, and a powerful tool for professionals who want to analyze the contents of their disks.

Get your hard disk back in shape—with new improved Version 2.0

Hard to believe, but new Disk Optimizer Version 2.0 is

even better than before. Not only will it optimize your disks in far less time than it used to, but it actually speeds up retrievals even more by letting you give priority treatment to your most used files, like programs and batches.

When you think about it, it's simple.

The longer you own your hard drive, the more you come to depend on it. But the longer you wait to get Disk Optimizer, the less performance you'll get.

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Buy Disk Optimizer at better computer dealers everywhere, or order today by calling SoftLogic Solutions at 800-272-9900 (603-627-9900 in NH).

Disk Optimizer \$59⁹⁵

Here's what people are saying about Disk Optimizer.

"I feel this is essential software for anyone with a hard drive."
—D. Simonson, TEXACO, California

"I find Disk Optimizer excellent. Disk access—even at 4.77MHz—is much faster. And loading 100+ Fontasy fonts now takes seconds."
—Elizabeth Jean Davis, Indiana

"Disk Optimizer... (has) found a permanent place on my software shelf."

—Stephen R. Davis, PC MAGAZINE

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\$395 ACT! Organizes Contacts, Expenses; Great for Travelers

PC HANDS ON

BY ELLEN R.S. BUSH

For the executive who has everything, including scads of scribbled notes, phone messages, and calendar entries, **ACT!** may be the way to make sense out of a hectic schedule. Like *Tracker* (reviewed in this issue's First Looks), **ACT!** offers a simple way to organize business contacts.

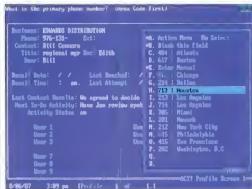
With varying degrees of effectiveness, **ACT!**'s integrated database, word processor, and desktop organizer manage correspondence, phone calls, meetings, tasks, and expenses.

A single predefined database is the basis for **ACT!**'s Activity menu. Information about each contact is maintained in a profile that includes two screens of database information and screens for history and notes. Fifteen user-definable fields provide customization beyond the standard name, address, and contact date fields. The history screen automatically captures all previous entries for selected fields but cannot be edited. This level of protection from your-

self seems excessive in a contact-management package. The notes screen partially makes up for it, since you can enter information that does not fit into any field.

that a letter has been sent. Compiling the correspondence task is easy with predefined formats for printing mailing labels or envelopes.

Scheduling is at the heart of



ACT! allows you to predefined "profile" screens but provides plenty of helpful touches: one menu suggests area codes when you enter phone numbers.

Pop-up menus give you some terrific shortcuts: in phone number fields, menus suggest area codes for major cities; in expense account payment fields, major credit cards are suggested. You can add new suggestions in any of them.

ACT! automatically sorts according to company name. Profiles can be retrieved according to a wide variety of preset criteria as well as user-specified criteria.

The Write option allows you to correspond with a contact. Like the rest of **ACT!**, Write is controlled by a Lotus-like menu. This is somewhat awkward for word processing, but **ACT!** wasn't designed for research papers and its features are adequate for business letters. **ACT!** assumes that you want to write a letter and automatically uses the current profile to create a removable header. The completed letter can be printed for the selected contact or mail-merged to all currently retrieved profiles. Profiles are automatically updated to show

ACT! You put phone calls, meetings, and tasks into the appropriate fields by using a handy pop-up menu or calendar. Although **ACT!** automatically allows time to get ready for meetings and maintains a minimum time between them, there's no way to schedule a meeting's length.

ACT!'s alarm reminds you of critical calls and meetings. Unfortunately, since the program is not RAM resident, the alarm won't sound unless you are working in **ACT!** Moreover, while **ACT!** will print your letters, it won't dial your phone since it does not have an auto-dialer.

ACT!'s reporting facility is quite sophisticated but complex. You generate customized reports by creating or modifying a script file for **ACT!**'s report interpreter. An assortment of (modifiable) built-in reports will meet most needs, but attempting to display them on the screen results in a "too long for screen" message.

The expense-reporting sec-

tion is great, with one shortcoming: those who bill expenses to clients will miss the ability to tie expenses to profiles. If you simply track expenses to generate periodic statements, the method works very well.

ACT! is clearly meant to be a standalone product, and that means there are limited import and export capabilities. Delimited formats and .SDF are supported for transfer of demographic data only. It is impossible to transfer history, dates, and user-defined fields without writing a custom report format, sending the report to a file, and reading the file into another program.

The **ACT!** manual is an "executive" fabric-covered binder filled with good tutorial information and extensive examples. The help function is not as impressive; it is not context sensitive and contains only a fraction of the manual's information.

Overall, **ACT!** could be a valuable tool for managing business contacts if you're willing to live within its constraints and don't want to learn another program. Its ability to handle integrated functions without requiring a hard disk makes it an ideal choice for laptop users.

If you're trying to manage a variety of contacts that don't fit neatly into **ACT!**'s traveling-salesman approach, *Tracker* would be a better choice.

PC Magazine's IRS Opens Lines in West

In response to reader requests, *PC Magazine* will open a West Coast branch of the Interactive Reader Service on September 1.

Sixteen lines will be active 24 hours a day, 7 days a week, in addition to the 24 lines now open in New York. The new lines will carry the same article indexes and programs from *PC Magazine*'s Productivity columns, in addition to providing a forum for contacting editors.

The new number is (415) 598-9100 and will operate at 300, 1,200, or 2,400 bits per second, at the protocol 8, N, 1. The New York IRS number remains (212) 696-0360.

PC FACT FILE

ACT!

Conductor Software Inc.
5215 N. O'Connor Blvd.,
Suite #200
Irving, TX 75039
(214) 869-9124
List Price: \$395

Requires: 420K RAM, two disk drives, DOS 2.0 or later.

In Short: An integrated database, word processor, and desktop organizer program, **ACT!** is limited to a single, contact-management database with only limited import/export facilities. Not copy protected.

CIRCLE 428 ON READER SERVICE CARD



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We're not selling printers, but a new networking device that'll make it seem like you have an extra one. Or two or three.

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All the right connections

The Buffalo SX is an intelligent buffer, switcher and interface converter all in one. It allows several PC users to select any output device connected to the network.

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But that's only the beginning. You can link more SXs together to share a set of peripherals with any number of PCs (of course, when you get up into the dozens, you might need another laser).

Power windows & automatic transmission

To set up the SX, just plug it in and define the ports using the switches and software provided. Concise documentation tells you how. If you have a question, call our toll-free support line.

When someone's ready to print, they simply use the handy little menu that pops up on screen with the names you've chosen. Call your printers Martha, Chatterbox, Relic, whatever.

The SX does the rest. It handles interface conversions, making parallel and serial machines

work together. Yes, it even lets IBM® and Macintosh® PCs share a laser with no fiddling. And PCs can exchange files with communications software.

Best of all, it stores print jobs in its large buffer and feeds data to the printers automatically. So people can use their computers within seconds. ("Large" means a standard 256K memory, expandable to one full megabyte.)

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Just one of dozens of network configurations possible with the versatile SX.



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Tracker Database Lets You Mix, Match Fields Within Its Records

PC HANDS ON

BY ELLEN R. S. BUSH

Despite claims that DayFlo Software Corp.'s *Tracker* could keep track of everything but my car keys, it didn't find my sunglasses. Actually, it could have told me where to find either had I simply created and used Possession Locator records. *Tracker* is an amazingly flexible tool that allows management of diverse data within a single database.

Like any other database, *Tracker*'s database consists of a series of records. But in *Tracker*, a record can be a conventional record of data fields or it can be any other combination of information, including a report format or a page of text. Records need not contain all the same fields; client records can peacefully coexist with expense records. A record can have just a single field for identification of a page of text or other noncategorized data. A single record can have multiple entries with the same field name. To keep track of all phone calls to a given client, add another phone-call field to his record for each conversation.

Tracker can search for all occurrences of the field or for the first occurrence only, so you can decide how this information will be reported.

A field dictionary lends structure to the database. Dictionary entries can have specified data types, patterns, and lengths; they can also be indexed. A field that is used in only a few records can remain a local field, without a dictionary definition.

SmartKey on Board

Tracker's primary user interface is a series of Lotus-like menus. Speed keys are another interface. This macro capability is provided by *SmartKey*, a 43K-byte resident program

loaded with *Tracker*. Since *SmartKey* loads on top of any existing resident programs, it may provoke a RAM war.

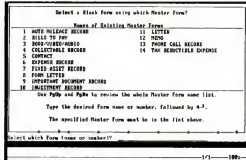
Records are stored in a database file on disk and moved to a stack in memory with the Get command. *Tracker* allows up to ten simultaneous conditions for getting records. A condition can be as specific as a field value or wildcard-indicated group of

replace activity, and an Undo command to rescue you from your mistakes.

Several editing commands are awkward to use. Changing video attributes requires a multistep procedure. Marking a range involves using the F7 key to mark the beginning of the range, moving to the end, and then initiating an editing activity; you can't highlight the



Tracker allows multiple fields with the same name in a single record.



The Application Pack menu pops up over a normal Tracker screen.

values or as general as the presence or absence of a specific field. Only records on the stack can be viewed, edited, or used in reports. Records are returned to disk via a File command.

Tracker's editing capabilities are rudimentary. The search-and-replace, cut-and-paste, and delete commands are all available. *Tracker* also provides an Aguin command to repeat the most recent search-and-

range.

Finally, to see the results of changing tabs or margins, you must use the Format command to reformat the record.

One specialized editing command is the EndVal command, which separates values within a field. This allows multiple keyword-type entries in a single field. Another unique feature is the FieldName command, a toggle between values

entry and field name entry. This ability to switch instantly between data and database structure highlights *Tracker*'s flexibility.

The Count key (F8) allows you to specify multiple executions of a command. This powerful feature applies to commands such as filing or paging through records, as well as to editing commands.

Switch Tracks

The *Application Pack* is a *Tracker* add-on that includes standardized forms and unique speed keys for four applications: contact manager, project manager, abstractor, and DOS file tracker. The applications are manipulated via pop-up menus, but standard *Tracker* commands are also operational. Pressing the Magic Key (Alt-F2) allows you to select DOS, *Tracker*'s TextIn program, or your choice of four user-specified programs.

The transfer command readily transfers data to and from DOS files. However, a record transferred into *Tracker* has only a single identifying field.

Tracker's documentation provides a solid tutorial and reference guide for the program. Program installation and start-up is easy. Ultimately the power and flexibility of *Tracker* justify the time required to master its intricacies.

PC FACT FILE

Tracker

DayFlo Software Corp.
17701 Mitchell Ave. North
Trvine, CA 92714
(714) 474-0229

List Price: \$149.95, *Application Pack*, \$39.95.

Requires: 384K RAM, hard disk drive, DOS 2.0 or later.

In Short: A versatile data management tool. While the program is easy to start using, it's difficult to master but worth the investment of time. Not copy protected.

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Lattice C Compiler	246			Smart Software System	426	MousePad by Mossmark	6
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Run C Interpreter	64						
Ryan McFarlin Fortran	339						
Ryan McFarlin Cobol	339						
Pascal Compiler (Microsoft)	189						
Quick Basic 3.0	55						
Turbo Basic	55						
Turbo C	159						
Turbo C++ Pack (New Ver.)	159						
Turbo Pascal w/8087 & BCD	55						
Turbo Prolog	54						
Turbo Prolog Toolbox	50						

Paradox Upgrade on a Network Allows Smooth Record Sharing

PC HANDS ON

BY GREG CAMPBELL AND
FRANK J. DERFLER, JR.

Ansa Software's *Paradox* is a sophisticated programmable relational database system that in spite of genuine power is easy to learn and use. *Paradox*, Version 1.1, has been on the market for over a year, but Ansa recently released a significant update, Version 2.0. The most important feature of this release is network support, but the applications generator and other portions of the program have also been significantly improved.

Paradox now runs on the popular PC-based LANs with sophisticated simultaneous file sharing among multiple users. There are two ways to get networked operation out of the new *Paradox*: buy multiple copies of *Paradox* 2.0 or buy the *Paradox Network Pack*. *Paradox* 2.0 is a multiuser networked database sold with a single-user license. When the basic system is installed on a network, only one station at a time can use the installed copy. This limitation is enforced by the software. If you buy additional copies of *Paradox*, you can "bump" the installation count to allow for more than one simultaneous user.

Paradox Network Pack includes *Paradox* 2.0; each copy allows up to six simultaneous users of *Paradox*, and each ad-

ditional *Paradox Network Pack* adds another six.

Among its new features are a Virtual Memory Management system that automatically manages EMS and EEMS memory. Also, you can now "zoom" to the records you want to edit using either exact, inexact, or wildcard search criteria.

Data is kept even cleaner in *Paradox* 2.0 with a strong suite of verification techniques such as lookups, range values, and unique value testing. Unlike those of many DBMSs, these data edits can always apply to your table, not just at those times when you use a particular data entry form. All data verification functions are also avail-

cludes network support. CoEdit looks like an ordinary tabular edit except that during CoEdit, *Paradox* automatically locks and unlocks records as you edit them. Changes made during CoEdit are instantly displayed on the screens of all users who are currently editing the same table.

While using CoEdit, if you attempt to edit a record that is locked by another user, a "record locked" message is displayed that shows the name of the user who has locked that record. This handy feature far surpasses the file-sharing sophistication of competing PC database managers.

Security within the program

Table NAME	Compnd Staff	Name	Address	Address2
1	181	Moore, R.	111 Magic Kingdom Way	9 Cot Gyle
2	182	Duch, B.	444 Radon Drive	Master Shot Spg
3	183	Coof, J. M.	222 Banana Lane	Shady Grove Bldg
4	184	Fleto, L.	777 Enterprise Street	Deborah's Hqs
5	121	Beard, Barry	888 Cedar road	Burman 12
6	122	Dalk, Manfred	121 Metropolis St.	Penthouse 3
7	123	Lee, Bruce	77 Sunset Strip	Seawall 382
8	228	Moore, R.	1 The Grand St	Bole 1
9	229	Bogers, Mister	123 Pleasant Lane	Bed 3
10	230	Moore, Bruce	121 Metropolis Way	Penthouse 3
11	334	Bill, Jeffery	221 Broken Arrow Road	Room 12
12	334	Braxton, L.	1 Shadow Lane	Cellar Room
13	345	Trot, Henry	22 Assembly Lane	Station 44
14	555	Beck, Clark	33 Goshen Way	Penthouse
15	667	Chen, Chewy	334 Lough Lane	Room 12
16	667	Center, George	121 Silver Leading	Section 7 Row 3
17	671	Zankow, Mark	1 Plush Way	Play City
18	731	Oliver, Hania	121 Smokehouse Way	Room 2
19	804	Hott, Bob	99 Rogers Way	Apartment 12
20	985	Brent, Rick	Spindrift Island	Building 22
21	996	Blair, Berny	12 Yellow Brick Road	Blackie's Village

On a network, *Paradox*'s CoEdit feature allows two people to make changes within the same record. Edits are immediately reflected at other PCs where the file is open.

able from the *Paradox* Application Language scripts.

The new CoEdit (concurrent edit) command is the most obvious clue that *Paradox* now in-

is provided through extensive password control.

Paradox is programmed with the *Paradox* Application Language, or PAL. PAL scripts can either be "recorded" during an interactive session or created from the *Paradox* Personal Programmer, an applications generator that is included with both *Paradox* 2.0 and *Paradox Network Pack*.

The Personal Programmer has been rewritten in C and is significantly faster than the previous version. Single-user scripts written under Version 1.1 are compatible with 2.0 with no modification.

With most applications gen-

erators (and *Paradox* 1.1), once you make manual changes to the generated script files you lose the ability to modify your application with the applications generator. *Paradox* 2.0 overcomes this problem by rewriting only modified script files.

Overall, *Paradox* is a very powerful multiuser PC database system that can meet most users' needs for a very reasonable cost per node. The natural process by which you refine your application through trial and error, combined with the easy-to-use interactive command menu, makes this database usable even if you're a novice.

PC FACT FILE

Paradox, Version 2.0

Paradox Network Pack

Ansa Software

1301 Shoreway Rd.

Belmont, CA 94002

(800) 826-4768

(800) 672-3366 (in Calif.)

List Price: *Paradox*, \$725; up-

grade, \$139; *Paradox Network*

Pack, \$995; no upgrade policy.

Requires: *Paradox*, running

standalone: 512K RAM, two

disk drives, DOS 2.0 or later.

Paradox, on a network: 640K

RAM, two disk drives, DOS 3.1

or later. *Paradox Network*

Pack: 640K RAM; one of the

following network programs:

Novell's *Advanced NetWare*

2.0A or later, 3Com's 3Plus 1.0

or later, IBM's *PC Local Area*

Network Program 1.12, *Tor-*

us's Tapestry, AT&T's *Star-*

LAN Network Program; DOS

3.1 or later.

In Short: A powerful relational

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tively create and refine screens,

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use those objects either interac-

tively or in a programmed appli-

cation. Network support in-

cludes very powerful, automatic

record locking and deadlock

prevention—while still allow-

ing manual programming of re-

cord and file locks. *Paradox*

Network Pack runs up to six ses-

sions. Copy protected.

CIRCLE 421 ON READER SERVICE CARD

Paradox and SideKick Are Now Siblings

A marriage of mass-market and corporate sales cultures recently brought *Paradox* into the same family as that champion of low-priced utilities, *SideKick*. In July, Borland acquired Ansa in a move that is expected to help Borland sell its long slate of under-\$100 products—including *SideKick*, *Turbo Basic*, *Eureka*,

and *Reflex*—to corporations, where sales of Ansa's \$725 *Paradox* have been strong.

Will it mean lower prices for *Paradox*? Unlikely.

But Borland has announced plans to market a word processor and a spreadsheet that are expected to have prices well over \$100.—Gus Venditto



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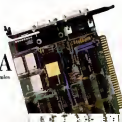


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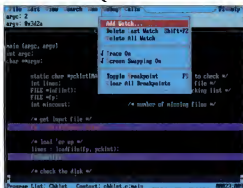
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CIRCLE 252 ON READER SERVICE CARD



Life is not fair.

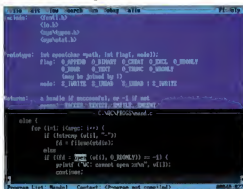
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Microsoft QuickC Compiler Feature Comparison

	Microsoft QuickC Version 1.0	Turbo C* Version 1.0
Debugger		
Integrated debugger and editor	Yes	—
Source-level debugging	Yes	—
Watch local & global variables	Yes	—
Set breakpoints	Yes	—
Stack tracing	Yes	—
Editor and Environment		
WordStar® compatible	Yes	Yes
Context-sensitive help for C language	Yes	—
Context-sensitive help for C functions	Yes	—
Brace, bracket & parenthesis matching	Yes	—
Mouse support	Yes	—
Support for EGA 43-line mode	Yes	—
Documentation		
Complete C language reference	Yes	—
Examples for every library routine	Yes	—
Compiler		
Completely Microsoft CodeView compatible	Yes	—
Automatic error-checking	Yes	Yes
Integrated MAKE		
Automatically generates .MAK file	Yes	—
In-memory MAKE compatible	Yes	—
with stand-alone MAKE	Yes	—
Include file dependencies	Yes	Yes
Libraries		
Graphics library included	Yes	—
CGA & EGA and VGA support	Yes	—
Library source code available	Yes (\$150)	Yes (\$150)
Microsoft C Optimizing Compiler 5.0 compatible	Yes	—
Microsoft LINK vs. Turbo Link		
Links programs up to 640K	Yes	—
Supports overlays	Yes	—
Directory searching for library files	Yes	—

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CIRCLE 514 ON READER SERVICE CARD

We wanted this to be a fair comparison.

Turbo C

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Only QuickC has special context sensitive help for the C language and library routines. And help is right where you need it. On screen, so you don't have to go looking for it.

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No graphics library.



No on-line help for the C language or library routines.

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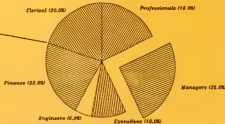
September 15, 1987

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CIRCLE 251 ON READER SERVICE CARD

First Add-in RAM Board for the PS/2s Ships: 2 Megs for \$995



HANDS ON

BY WINN L. ROSCH

With the introduction of Orchid Technology's RamQuest 50/60, the big question about IBM's new Personal System/2 series of computers—whether the aftermarket will support the new standard—has been answered in the affirmative.

The \$995 RamQuest 50/60 is the first third-party memory

Model 60, little is truly revolutionary about the RamQuest 50/60.

Its RAM endowment is implemented with eight parity-checked banks of 256K-byte SIMMs (single in-line memory modules), each comprising nine 256K-bit, 120-nanosecond DRAM chips.

The SIMMs are soldered to the main card. Add in the necessary bus interface circuitry and the RamQuest is complete—if unremarkable.

ic chips). Four others have had their identifying marking eradicated, ostensibly to make the board difficult to clone and difficult to repair outside the Orchid factory.

Deciphered ID Number

Orchid, however, has copied something from IBM: the ID number that the PS/2 BIOS looks for in each add-in card on boot-up, before the BIOS configures the system. IBM has been slow in assigning individual numbers to manufacturers of boards and peripherals, so Orchid has deciphered the number that IBM's own memory card uses and has put it in the RamQuest's firmware. Other memory board makers are planning to do the same thing.

The RamQuest clearly does what it's supposed to, but in a world in which OS/2 is still a promise, and 640K is still the maximum memory that DOS can address directly, what will you do with this massive RAM capacity? Few DOS programs take advantage of the extended memory area that the 80286 microprocessor can address.

To sidestep that dilemma, Orchid includes a 3½-inch floppy disk containing several utilities that help take advantage of



Orchid Technol-
ogy's RamQuest 50/60 is the first
add-in RAM board for the PS/2's Micro Channel to reach the
market. Orchid uses the PS/2 BIOS ID number that IBM reserves for itself

board on the market for IBM's new Micro Channel bus, bringing with it a full 2 megabytes of expansion memory that can be used as extended (protected-mode) or expanded (EMS) memory.

Other than its downsized package, designed to fit the confines of the PS/2 Model 50 or

its components are all old-fashioned lead-in-hole—PS/2-style surface-mount chips are unnecessary because the available space is more than adequate for the few functions needed.

Seven RamQuest chips are socketed, Orchid-proprietary PALs (programmable array log-

PC FACT FILE

RamQuest 50/60

Orchid Technology Inc.
45365 Northport Loop West
Fremont, CA 94538
(415) 490-8586

List Price: \$995

Requires: PS/2 Model 50 or 60.

In Short: The first EMS board for the PS/2, complete with 2 megabytes of RAM in addition to an EMS driver, a RAMdisk, a disk cache, and a print spooler.

CIRCLE 427 ON READER SERVICE CARD

the RamQuest's extra memory endowment.

These include a print spooler (which, inexplicably, works only in base memory), a disk caching program, a RAMdisk emulator, and an EMS memory driver.

Of these, the last is potentially the most useful, allowing you to use EMS-compatible programs (for example, i-2-3, Release 2, Microsoft Windows, Framework II, and AutoCAD) in the extended PS/2 memory area.

Note, however, that this driver addresses only RamQuest memory and leaves the extra 384K bytes of extended memory in the PS/2 unused (see sidebar "The 384K That EMS Cannot Use on a PS/2").

No-Tools Design

In keeping with the no-tools expansion design of the PS/2, the RamQuest simply slides in and is secured with a single retaining bracket screw.

Orchid includes complete instructions for software installation, too, taking advantage of the PS/2's automatic configuration program.

This easy installation is a result of IBM's PS/2 design, of which Orchid merely takes advantage. Despite what must have been a rush to the market, the RamQuest 50/60 is a quality product in terms of design and construction—one that begins to fulfill the promise of the Micro Channel.

The 384K That EMS Cannot Use on a PS/2

While memory expansion on the PS/2 Micro Channel can be a blessing to EMS designers, RAM on the system board can be a plague.

IBM's design for add-in RAM boards on the Micro Channel includes bank switching, which Big Blue uses for its switchless configuration procedure, as well as during the computer's Power On Self Test (POST) to inactivate bad chips without adversely affecting the bulk of memory.

Because bank switching is at the heart of the EMS design

specification, this Micro Channel memory can be easily made to conform to the specification through emulation.

The first megabyte of RAM on the PS/2's system board is not bank switched, and so you lose the best method for swapping data in and out of expanded (EMS) memory. The alternative is block moves, a slower process.

It is so slow, in fact, that Rocke Verser, designer of the EMS software utility V-EMM (the Virtual Expanded Memory Manager), concedes that using

planar RAM for EMS is slower than swapping bytes to hard disk and back again (a technique called virtual memory).

According to Verser, the only time to use the 384K bytes of extended memory on the PS/2 planar board for EMS is when every byte counts and you need as much EMS memory as possible.

The latest version of V-EMM will happily, albeit slowly, use system board RAM as EMS.

So for now, the only practical use for that 384K on the PS/2's system board is as a RAMdisk or for disk caching.

—Winn L. Rosch

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CIRCLE 353 ON READER SERVICE CARD

Chip News Points to New Systems; 16-MHz 80286, VGA Chip Sets Due This Fall

PC HANDS ON

BY GUS VENDITTO

Chip designs that are now passing from the blueprint stage into silicon will be at the heart of some of this fall's hotter systems and expansion cards.

Advanced Micro Designs (AMD) will be supplying PC manufacturers with a 16-MHz version of the 80286 microprocessor in the fall. Although some PC makers shipped a small number of 16-MHz 286 computers late last year, 16-MHz chips have not been mass-produced; those prototype systems were based on the cream of the 12.5-MHz crop.

Most of the PCs built around AMD's 16-MHz chip will probably take advantage of NEAT, a New Enhanced AT chip set

from Chips and Technologies, which makes it possible to create a 16-MHz AT compatible with only 24 chips, not counting RAM.

The NEAT chip set will incorporate an EMS manager and will allow the system bus to run at a slower speed than the microprocessor, using command delays and wait states if necessary to accommodate expansion cards that have problems run-



AMD makes 80286 microprocessors under license from Intel.

ning faster than 8 MHz.

At least three chip makers are about to ship VGA chips. This fall, Chips and Technologies, Paradise Designs, and Tseng Labs will be selling chips that provide EGA compatibility and the same high-resolution, 256-color mode IBM introduced in April.

Makers of graphics cards will have to choose among nuances of these differing chip designs. Tseng and Paradise say their chips will have full-register-level compatibility with IBM's VGA; Chips and Technologies says its chip will be BIOS compatible for mode switching but will support pixel updates at the register level.

Chips and Technologies and Tseng will offer additional high-resolution modes. All three will offer something IBM does not: Hercules graphics.

Prices for these chips will not be far above the current cost of EGA chips.

PC FACT FILE

Turbo C, Version 1.0

Borland International Inc.
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(800) 255-8008
(800) 742-1133 (in Calif.)

List Price: \$99.95

Requires: 384K RAM, two disk drives, DOS 2.0 or later.

In Short: Turbo C brings the same fast-compiling, menu-driven environment to the C language that Borland has brought to BASIC, Pascal, and Prolog. Not copy protected.

CIRCLE 438 ON READER SERVICE CARD

Turbo C

(continued from page 33)

diate link step—the necessary Turbo C routines are automatically included from the proper .LIB files. The whole process is so automated that you are not really aware of the different steps being performed.

If a program consists of

more than one C source file, the Project menu must be used to create a simple project file. A Make utility, integrated into the Project menu, checks the project file and automatically compiles modified source files before linking them together.

The Options menu is perhaps the most exciting aspect of the IDE. While other compilers

usually allow you control through complicated switches, the Options menu in Turbo C lets you select these features from a menu.

The only notable lack in Turbo C is an integrated debugger. This omission is just as inexplicable as its absence from Turbo Pascal. A Debug menu selection is provided, but it doesn't

do anything useful. Fortunately, Turbo C can generate a load map for use with source code debuggers, from Symdeb, Periscope, and PFIx.

For those more comfortable with command line operation, a separate version of the compiler, linker, and make utility are provided.

Turbo C represents an all-new price-performance level—one that will be hard to match, much less beat, although Microsoft is about to try: in the coming months a fast, inexpensive compiler, Quick C, is due from Borland's rival.



Benchmark Tests: Turbo C 1.0 vs. Microsoft C Compiler 4.0

Turbo C's speed advantage is in compiling—a dramatic fourfold increase. During program execution, however, it outperforms Microsoft C Compiler only in floating-point operations. Microsoft C Compiler ties or beats Turbo C on most numeric, screen write, and file operations, and there's little difference between the two on most looping or integer function calls.

Performance Times

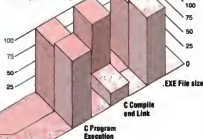
	C Program Execution (minutes)	C Compile and Link (seconds)	.EXE File size (K bytes)
Microsoft C Compiler 4.0	266	357.5	73
Turbo C 1.0	279	80.4	81

The C Program Execution benchmark test times the execution of a series of integer, floating-point, character-string, control-statement, and file operations. The cumulative execution time in minutes is presented to give a simple comparison of CPU-bound performance. These tests are run on an 8-MHz IBM PC AT under DOS 3.2; file operations are performed on a RAMdisk with BUFFERS set at 3.

The C Compile and Link benchmark test measures compile and link operations, including linking all run-time support. DRI reports the size of the resulting .EXE file, and the test shows the elapsed time for the compile and link operations performed on a 5,530-line program.

Relative Times

(Microsoft C Compiler 4.0 = 100)



First PS/2 Tape Backup Drives Arrive from Mountain, Maynard

PC HANDS ON

BY MITT JONES

PS/2 owners, relax: two top-notch tape drive manufacturers have already adapted popular tape backup systems to the PS/2 line.

Maynard Electronics is offering both internal and external versions of the Maynstream 60, which includes a full-length PS/2 adapter card. The drive uses QIC-24 tape to pack 60 megabytes on an audio-size digital cassette. The Maynstream 60 works with PS/2 Models 50, 60, and 80.

Mountain Computer has adapted internal and external versions of its 40-megabyte Mountain TD4440, an Editor's Choice in our recent roundup of DC2000 drives ("DC2000 Systems: Pocket-Size Backup," *PC Magazine*, Volume 6 Number 12). The Mountain TD4440 will soon work with the Model 80, but as of this printing worked with only the Models 50 and 60. Installation in the Mod-

el 50 requires a \$49.95 adapter board.

We tested external versions of each product with a PS/2 Model 60.

To install the Maynstream hardware, you plug its adapter card into the PS/2 and connect the cable between the drive unit and the adapter.

The Mountain drive runs off a floppy disk controller instead of an adapter card. Attaching a ribbon cable to a floppy disk controller may sound easier than installing an adapter card, but in this case it's not, thanks to a hard-to-reach cable connection in the Model 60.

Once up and running, each of these drives performed without a glitch, though at much different speeds.

Chained to the slowness of DC2000 drives, the Mountain backed up our 10-megabyte test file in about 5½ minutes, yielding a backup rate of 1.78 megabytes per minute. The restore required 5 minutes and 10 seconds.

The impressively fast Mayn-

stream did each job in about 2 minutes, with a backup rate of 5.08 megabytes per minute.

Both Mountain's FileSafe software and the Maynstream software are powerful, and straightforward menus make them a breeze to use. Both let you schedule multiple automatic backups that wait in the background while you work and both give you ample options for selective backup.

Either of these tape drives would be an excellent choice for backing up your data. Though the Mountain TD4440 is slower than the Maynstream 60, it is quite a bit cheaper.

If you own one of these models already and want to upgrade it for use with a PS/2, or if you want to buy one drive and move it around from machine to machine, you're in luck. Maynard sells its PS/2 adapter card separately for \$295, and Mountain sells its PS/2 cable adapter kit for \$39.95. With the appropriate adapters, you'll be able to use your one unit to shuffle data among XT's, AT's, and PS/2's.

PC FACT FILE

Maynstream 60

Maynard Electronics Inc.
460 E. Semoran Blvd.
Casselberry, FL 32707
(305) 331-6402

List Price: \$1,795, external version; \$1,295, internal version; PS/2 adapter board, \$295.
Requires: 512K RAM, DOS 3.3.

In Short: A speedy, 60-megabyte tape backup unit for PS/2 systems.

CIRCLE 438 ON READER SERVICE CARD

Mountain TD4440

Mountain Computer Inc.
360 El Pueblo Rd.
Scotts Valley, CA 95066
(800) 458-0300
(408) 438-6650 (in Calif.)

List Price: \$899, external version; \$595, internal version; PS/2 Model 50 adapter board, \$49.95; PS/2 adapter kit, \$39.95.

Requires: 312K RAM, DOS 2.1 or later.

In Short: An excellent DC2000 tape unit that runs off the floppy disk controller.

CIRCLE 437 ON READER SERVICE CARD

Hand-held Scanner Reads Typeset Text

PC HANDS ON

BY HOWARD MARKS

Ever since the first OCR (optical character reader) scanners were introduced, the ultimate goal has been an inexpensive scanner that could read both typed and typeset text. The \$2,595 TransImage 1000 brings the ultimate one step closer. Less than a quarter of the price of the next-least-expensive OCR that can read typeset text (Kurzweil's \$9,950 Discover 7320), the TransImage 1000 is the first hand-held OCR scanner to read typeset text.

TransImage Corp.'s scanner consists of a hand-held "camera"; a full-length card with a 10-MHz Motorola 68000 pro-

cessor and three-quarters of a megabyte of RAM on board; and the related software. The scanner puts scanned data into your PC's keyboard type-ahead buffer, so scanned data looks as if you typed it on the keyboard.



The TransImage hand-held camera has built-in optics to guide you over the area you're reading, and rollers to help keep the camera on a single line, but it still requires good hand-eye coordination.

The camera has six programmable buttons that can emulate the cursor keys, Esc, and Enter.

The software includes applications packages for *WordStar*, *WordPerfect*, 1-2-3, and other popular applications. These packages tell the scanner how to handle tabs, vertical rules, the end of a line, and other parameters.

The manufacturer expects that the TransImage will be used to scan excerpts from *Business Week*, trade journals, books, and other printed media. Unfortunately, using the TransImage requires a good amount of hand-eye coordination, and it's difficult to scan close to the binding on magazines.

While the TransImage 1000 is truly an advance in OCR tech-

PC FACT FILE

TransImage 1000

TransImage Corp.
910 Benicia
Sunnyvale, CA 94086
(408) 733-4111

List Price: \$2,595

In Short: A hand-held OCR scanner that reads typeset, laser, typewritten, and near-letter-quality text in all common fonts.

CIRCLE 440 ON READER SERVICE CARD

nology, it's not nearly as valuable as Kurzweil's full-page Discover reader (see First Looks, page 33, *PC Magazine*, Volume 5 Number 13). The real question is whether anyone needs a hand-held scanner for typeset text.

PS/2 Model 25

(continued from page 33)

faster than with most EGA systems. Like the other PS/2 analog monitors, the Model 25's suffers from slightly fuzzy text display but boasts brilliant color/graphics modes.

Expansion is limited. Two PC bus slots are provided in the same kind of right-angle scheme used in the Model 30. But because the boards are housed beneath the monitor, which closes over the expansion boards at an angle, only one of the boards can be full size; the other can be no longer than 8 inches.

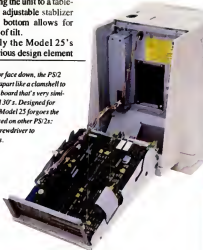
This bus-extender card has a better design than the Model 30's; rather than a flimsy circuit board standing with the aid of a thin plastic link to the chassis, the Model 25's bus connector is supported by a sturdy plastic housing screwed to the system board.

This and a number of other touches reflect IBM's keen ability to mix efficient design and rugged construction. The monitor is housed in a layer of sheet metal that will keep curious hands from getting too close and that adds poundage to a compact but heavy machine (the black-and-white model is 27 pounds; the color unit, 38). A strip of hard plastic runs across the machine's bottom, providing sock-

ets for bolting the unit to a tabletop, and an adjustable stabilizer bar on the bottom allows for three levels of tilt.

Probably the Model 25's most precarious design element

With the monitor face down, the PS/2 Model 25 pulls apart like a clamshell to reveal a system board that's very similar to the Model 30's. Designed for school use, the Model 25 forgoes the thumbcrews used on other PS/2s; you'll need a screwdriver to open the chassis.



is the way you open the machine to get to the system board. With the monitor face down, you pull the bottom of the unit up and away, but not off—a clump of colored wires bind the monitor to the system unit and allow the system board to dangle. Clearly IBM doesn't expect that there will be too much traffic into this area. And anyone who does venture inside should be careful. After I paid one visit, the screen booted in purple on black, instead of white on black: I had let the monitor connector

be pried halfway off the system unit; it was easily fixed, but disconcerting.

The most frustrating aspect of the Model 25 is the lack of any hard disk option. Hard disk cards won't fit because they're too wide. Until someone designs a disk drive/controller that will fit in the 3½-inch disk drive slot, this machine will be relegated to light tasks.

The most curious aspect of this offer is the Collegiate Kit, in which IBM bundles DOS 3.3, a PS/2 mouse, and a cus-

tomized version of Microsoft Windows, Version 1.04. Any teachers that prescribe this package for a class will be educating their students in frustration: whatever customization went into this version of Windows did not address the tedium caused by constant disk swapping.

Dollar for dollar, the PS/2 Model 25 is one of IBM's bargains. It's not one of IBM's powerhouses.



FACT
FILE

IBM Personal System/2 Model 25

IBM Corp.

Contact your local authorized IBM dealer.

List Price: With black-and-white display, \$1,350; with color display, \$1,695; enhanced keyboard, \$45; second disk drive, \$170; Collegiate Kit, \$314; DOS 3.3, \$120.

Requires: DOS 3.3.

In Short: A well-crafted, fast computer for places where real estate is at a premium. Lack of a hard disk option relegates this computer to light duty.

CIRCLE 428 ON READER SERVICE CARD



Benchmark Tests:

IBM Personal System/2 Model 25 vs. IBM PC-XT

The Personal System/2 Model 25 runs even with a Model 30 on just about every benchmark test, which is twice as fast as the IBM PC-XT. There's no hard disk option on the Model 25, but our tests showed access times on the 3½-inch disk drive to be about 290 milliseconds.

Performance Times (Times given in seconds)

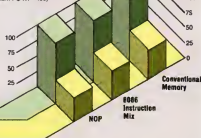
	NOP	8086 Instruction Mix	Conventional Memory
IBM PC-XT	10.1	32.0	5.9
IBM Personal System/2 Model 25	4.2	16.3	3.2

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. The test executes almost nothing but NOP ("no Operation") machine code instruction in a big 128K loop.

The **8086 instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64K-byte records, then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

Relative Times (IBM PC-XT = 100)





FIRST LOOKS

PS/2 Model 25 Looks Like a Mac, Runs Like a Model 30



HANDS ON

BY GUS VENDITTO

IBM Corp. thinks the Personal System/2 Model 25 will be your kid's first computer. And if IBM's salespeople offer sharp enough discounts to compete with recently announced bargains from Tandy, there's a good chance it will.

The Model 25 may also pop into many networked offices, onto desks where light access to shared applications is needed.

Running an Intel 8086 at 8 MHz with no wait states, this Mac-alike PS/2 has a lot of performance for such a small package. With a width of 12 1/2 inches

at monitor level and 9 1/2 inches at its base, the midget 25 is only 14 inches deep—small enough to sit inside the in-boxes on many desks. And with the monitor and system board sharing the same chassis, cabling is reduced.

The Model 25 introduces a "space-saving" keyboard that adapts the PS/2 keyboard (also known as the enhanced AT keyboard) into a 15 1/2-inch-wide package by deleting the separate number pad but leaving in the firm IBM keypad touch. Yes, it will work with other PS/2s, although IBM is not selling it separately. The full-size keyboard will be available in October as a \$45 option for the Model 25.



The Model 25 looks portable, but it's heavy and has no handle.

All of the innovation went into the exterior design, however. Inside, the Model 25 runs off a system board that is very nearly identical to the Model 30's: there's MCGA graphics; a serial port, parallel port, and mouse

port; 512K bytes of RAM in two banks of SIMMs (single in-line memory modules); a socket for an 8087; and sockets for an extra 128K RAM. IBM will sell you an expansion kit for \$49, but you can use off-the-shelf DRAMs to plug in the extra 128K on your own.

Most of the initial press reports made the Model 25 sound like the PCjr rising from its grave, but those comparisons are off the mark. PC Labs benchmark tests confirm that this PS/2 member performs at twice the speed of a 4.77-MHz PC-XT, and with the graphics adapter on the motherboard, screen writing is smoother and

(continues on page 34)

Borland International Puts C in Turbo Mode for Fast Compiling



HANDS ON

BY STEPHEN RANDY DAVIS

After one of the longer drumrolls in the history of personal computing, Borland has begun shipping Turbo C, the newest member of its family of languages.

Turbo C is an extremely fast, one-pass compiler that implements the proposed ANSI standard for the C language. Improvements over the Kernighan and Ritchie standard include stronger type checking, proce-

dures prototype definitions, and enumerated data types. Turbo C supports Microsoft C extensions, including the pointer descriptors Near and Far.

Turbo C is centered around a menu-oriented shell called the Interactive Development Environment. This same IDE is used in Borland's Turbo Prolog and Turbo BASIC, although it differs from Turbo Pascal's.

After selecting a C source file, you're placed in the editor. The Turbo C editor is very similar to the Turbo Pascal editor—it uses the WordStar command set, unless you take

advantage of options that let you change the editing commands.

Once edited, a C program is compiled from a menu selection. Turbo C offers two possibilities: Compile to Object and Compile to .EXE. The ability to generate an object file and go through a subsequent link step was a capability sorely lacking in Turbo Pascal. Turbo C supports compilation of individual C source files, as well as linking with other languages, including assembler.

Compiling a simple program to an .EXE file effects an imme-

(continues on page 36)

HANDS-ON INDEX

PS/2 TAPE DRIVES

QIC-24 from Maynard, DC2000 from Mountain... **35**

TRANSIMAGE 1000

One smart scanner..... **35**

RAMQUEST 50/60

Two megs for the MCA... **38**

PARADOX 2.0

Has network support..... **43**

TRACKER

Flexible text base..... **46**

ACT!

Manages contacts..... **48**

QUICK LOOKS

FormTool 2.01,
MousePerfect 2.02,
PC-TelePost..... **66**

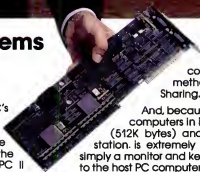


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stations all sharing the programs and data at a fraction of the cost compared to conventional methods such as LAN or Time-Sharing.

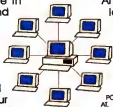
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CIRCLE 161 ON READER SERVICE CARD

■ PC ADVISOR

number or the issue date. Availability of issues dated prior to 1986 (that is, Volume 4 and earlier) is limited.

PUT RANDOM NOTES INTO ORDER

I have about 26,000 pages of handwritten research notes spanning a period of 15 years. I'm planning to enter the notes onto a hard disk.

The notes are in diary form, organized by daily entries only. I need the ability to retrieve a day's notes and also to compile all I've written on any given subject. Can you recommend the right program to create a database so that I can index my notes by topic, person, and so on as I enter them?

Eugene R. Sorensen
Bothell, Washington

You need a package that will give you more flexibility than a database offers. Rather than entering your notes in even loosely defined fields, store them as free-

form text. There are several packages that will allow you to index your collection of notes and perform sophisticated searches.

If you haven't already settled on a word processor, your best bet may be Nota Bene (Dragonfly Software, New York, N.Y.; (212) 334-0445; \$495). In addition to a full range of word processing features, Nota Bene has powerful text-indexing and -retrieving capabilities.

One of the program's chief attractions is the flexibility it gives you in organizing your notes. Nota Bene's textbase lets you index text from as many as 65,000 "entries." You can specify in a variety of ways what constitutes an entry. Each entry can be a few words, a paragraph, or an entire file, but you're limited to about 1,000 words per entry and 1,800 files per hard disk textbase.

Nota Bene can automatically index as many as 65,000 significant words. You can also mark words to be indexed.

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If you're already using a word processor that you can't bear to cast aside, you'll probably want one of the excellent packages that do nothing but index and search free-form text.

ZyLAB Corp. (Chicago, Ill.; (800) 544-6339) offers three variations of Zylndex—its powerful, well-established text-retrieval package. The \$695 version allows fast, sophisticated searches through as many as 15,000 indexed files. The \$295 Professional version limits the number of files to 5,000, and the \$145 Standard version limits files to 500. Zylndex can search ASCII files and files from about 15 popular word processors.

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Help in finding disk-caching software, in solving an expansion problem, in choosing text-retrieval software, and in ordering PC Magazine reprints.

IS THE MODEL 30 A GOOD BUY?

I am interested in purchasing an IBM Personal System/2 Model 30 in the near future. My problem is that I need to put more boards in the computer than there are slots. I want to connect a Bemoulli Box, an internal modem, a memory board, a Copy II PC Option Board, and a MIDI board.

What can I do to solve this problem?

Feliberto Escobar III
Corpus Christi, Texas

When you've outgrown your system before you buy it, it's definitely a sign that something's wrong and you should opt for a different system. My rule of thumb is to count the expansion slots you know you'll fill and add at least two. Don't settle for less. Clearly, the Model 30 would force you to compromise: it has only three slots.

But don't despair. The world is rife with attractive, low-cost alternatives to the Model 30. While IBM designed the other PS/2 models around a new bus design, the Model 30 offers little or nothing that XT and AT compatibles don't—aside from the IBM name. It's true that IBM has built an excellent reputation for customer support, but you'll find that some other major players—such as Compaq and Zenith—also excel in this area.

If it's the Model 30's speed and small footprint you're after, peruse our recent roundup of small-footprint PCs ("Taking Back the Desk," PC Magazine, Volume 6 Number 6). The PC's Limited 286-8, one of two Editor's Choices in the review, beats the Model 30's price and performance and packs eight slots. This manu-

facturer, too, has added an extensive nationwide service policy recently.

If a palatable price tag is more important to you than a small footprint, you may find your dream machine in "The Cheapest PCs Ever" (PC Magazine, Volume 5 Number 17) or "The Cheapest ATs Ever" (PC Magazine, Volume 5 Number 18), where you'll find our test reports on a wide range of machines.

USING CACHES IN EMS

I have an AT-compatible system with 1 megabyte on the motherboard—640K bytes of conventional memory plus 384K extended memory. I know Microsoft will eventually release OS/2, which will allow applications to access extended memory. In the meantime, I want to use some of the extended memory as a disk cache to speed disk-intensive applications.

I've looked at PC Support Group's caching program, *Lightning*, but that

package can't use extended memory. Do you know of any caching programs that allow use of extended memory?

Dr. Samuel M. Gon III
Honolulu, Hawaii

You can put up to 1 megabyte of extended memory to good use with Multisoft Corp.'s Super PC-Kwik (Beaverton, Oreg.: (503) 642-7108; \$79.95).

To instruct Super PC-Kwik to use extended memory, you simply add one parameter to the command that invokes the cache. With a few additional keystrokes, you can even persuade the cache and any RAMdisk to coexist peacefully in extended memory.

PC MAGAZINE REPRINTS

I'm trying to find reprints of several PC Magazine articles. Are reprints or back issues available? If so, what is the proper method of obtaining them?

Richard G. Keller
Fort Thomas, Kentucky

■ **When you've outgrown your system before you buy it, it's definitely a sign that something's wrong and you should opt for a different system.**

You can purchase article reprints by calling the PC Magazine reprint service at (212) 503-5447. Be forewarned, however, that the minimum quantity per reprint order is 500.

If you're only trying to get your hands on a PC Magazine golden oldie or two, ordering back issues is a better alternative. Send a check or money order in the amount of \$8 per issue (\$9 outside the United States) to Kim Armstrong, PC Magazine, One Park Avenue, New York, NY 10016. Be sure to specify the volume and issue



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hard drive

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Reflex.....	89.
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EGA Paint.....	55.
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TOP'S TOP UTILITY IS TO PROGRAMMING PRODUCTIVITY

SUPER SOURCE

Two great debugging and documentation tools that support C, Modula, Pascal, BASIC, and dBASE

Source Print

Author Alan Simpson writes "the best overall debugging technique is to draw lines to connect all the IF's and DO WHILE's etc. with their ENDFIX and ENDDO's. Use a pen or pencil to 'Well thanks, Alan, but we'll let Source Print do it for us. It draws vertical lines to connect all such beginnings and endings in a vivid display of your program's organization. And it can print programs with page numbers, headings, line numbers, under automaticity, throw in a table of contents and a cross-reference index." "Occasionally a utility comes along that makes a programmer's life much easier. Source Print is such a program!" says PC Magazine. List \$75. Ours \$65.

..and Tree Diagrammer

Tree Diagrammer prints an organization chart of your program's structure showing the hierarchy of function, procedure, and subroutine calls. Shows at a glance what routines call each other for cleaner debugging. Every spot should have the important documentation list. List \$85. Ours \$45.

BASTOC Translates BASIC Into C OPTIMIZE!

For a testing pace, BASTOC moves trackloads of BASIC code over to C. It's a translator which takes in Microsoft Extended BASIC and emits pure KAR C for Microsoft or Lotus. Structures even convoluted BASIC code. Optimized to dramatically reduce execution time. Converts to integers those variables in

BASIC programs which do not need floating point. Where BASIC was full assignment statements to increment counters, BASTOC converts to C's compact form. Dynamic array allocation needs BASIC's automatic garbage collection. Huge worksheet. Ask for 50375, List \$495. PC Brand \$395.

PANEL PLUS Library Source For Complete Portability

There are no screen design and data entry tools quite like Panel Plus. Design a screen under program control, use Panel's utility to "run" and test it field by field, then pass it to Panel's code generator which delivers C source code. Options style the code to your computer's liking. Then do whatever you want to the source afterward. The code calls Panel Plus's function library, but now the library comes in source, so

everything produced is highly portable. Not like screen managers that deliver object libraries leaving you to write the detailed code.

A single screen can have 1000 fields stacked as visual overlays up to 127 levels deep or as pop-ups. Each field can be boxed, colored, multi-row word-wrapped, scrolled both ways if larger than its view aperture, assigned a help and error message, accept only

certain characters, or match a picture, check days after entry—proper dates, number ranges, etc.—or against your own validation routines. Customize Panel's test utility with these routines. Panel Plus will operate in graphics mode via interfaces to graphics products it supports. Handles EGA & 43 line screen. Adapts to various keyboards, screens, operating systems. May not tool for the network developer. List \$495. PC Brand \$395.

Shopping List for the Power Workbench

ARITY PRODUCTS			LIST US			LIST US			LIST US		
Arity Combination Package	1085	87	Greenleaf Communications by Greenleaf	185	138	MODULA 2 Magic Pkg by LOGITECH	99	78	MODULA 2 ROM Pkg by Cross & Arty Debugger	299	239
Expert System Development Pkg	20	44	C UTILITY LIBRARIES	175	117	MODULA 2 WAP Pkg by LOGITECH	49	39	MODULA 2 Wizard Pkg by LOGITECH	199	158
File Interchange Toolkit	50	44	Blaize C Tools Plus	175	117	OTHER LANGUAGE & UTILITIES					
PROLOG Compiler & Interpreter	650	569	Blaize C Tools	125	84	Source Print...source code formatter	75	60	Tree Diagrammer...source code diagrammer	95	45
Screen Design Toolkit	50	44	C Food Source Toolz	100	87	HelpControl by MDS...123 style help	125	109	Microsoft Pascal Compiler with MultiScreen	300	199
SO Development Package	295	228	C Build/Source Support by Lattice	150	109	Arbortext...text editor with macros	125	99	Microsoft Pascal Compiler for XENIX	695	546
Arity PROLOG Interpreter	295	228	C Utility Library by Essential...200 functions	185	139	Arbortext...text editor with macros	125	99	Turbo Pascal Compiler	100	85
Arity Standard Pkg	95	77	Greenleaf Functions by Greenleaf Software	185	139	Advantage C++ by Libeal Associates	495	435	PHOENIX PRODUCTS		
AI-EXPERT SYSTEMS			COBOL LANGUAGE			RANMOS Macro Assembler			195	125	
AutoIntelligence by IntelligenceWare	990	739	RMCOBOL...see Ryan-McFarland Prod	700	499	FDisk Pro...hard disk manager	195	125	Plantayr Pac sys products...New Price	995	Call
ExpertShell II by IntelligenceWare	475	339	Microsoft COBOL Compiler for XENIX	995	795	PFMainE XE performance analyzer	395	235	PixC++ v3.1	395	235
EXSYS Development Software by EXSYS	650	469	Micro Focus COBOL...see Micro Focus Prod			PixC++ v3.1 Symbolic Debugger	395	235	PixC++ v3.1...Function Library for C++	395	235
EXSYS Runtime System	650	469	JBASE SUPPORT			Plinkit...UNIX library for overlays	495	325	PixC++ v3.1...Function Library for C++	395	235
Insight 2+ by Level Five Research	465	378	BRIEFVIEW...Brief for DBASE III	275	Call	Praker aka UNIX "make"	125	95	Plinkit...UNIX library for overlays	495	325
IntelligenceWare Compiler for IntelligenceWare	990	738	CLIPPER...from Natvision	695	Call	Praker with Macros	195	115	Plinkit...UNIX library for overlays	495	325
AI-LISP LANGUAGE			CUTLIP...from Natvision			PTI Binary File Communicator	95	115	POLYTRON PRODUCTS		
IOCLISP by Integral Quality	300	328	MacMS...Call for MAC from Natvision	350	299	PVCS Corporate...Source Code Control Sys	395	309	PVCS Personal	Call	Call
IOCLISP by Integral Quality	270	189	dbx...BASE to C translator by DESKTOP AI	350	299	PVCS Network	Call	Call	PolyMake Complete Make Utility	149	109
Microsoft LISP Common Lisp	250	189	with Library Source Code	350	299	PolyMake Complete Make Utility	149	109	PolyShell Library Manager	99	73
Transalisp from Solution Systems	195	148	with Full Source Code	1000	695	PolyShell LIBRARY Manager	149	109	PolyShell UNIX-like Command Shell	149	109
TRANSALISP from Solution Systems	195	148	dbx...BASE to C translator by DESKTOP AI	350	299	PolySHREX Complete Cross Ref Utility	219	189	PolySHREX One Language only	129	99
AI-PROLOG LANGUAGE			DEVELOPMENT TOOLS			PolySoft...The Software Accelerator	80	64	PolySoft III 3rd Generation Desktop Org	99	73
APT Active Prolog Tutor from Solution Sys	65	Call	BASTOC by JMI...convert BASIC to C	495	399	PolySoft Add-On Tools	Call	Call	RYAN-McFARLAN PRODUCTS		
MPROLOG PROLOG by LOGICWARE	50	45	BASIC C BASIC's functions added to C	175	139	RMFORTRAN 2.4 New	595	499	RMFORTRAN UNIX or XENIX	750	599
MPROLOG P500 by LOGICWARE	495	395	Report/Source Translator by DESKTOP AI	350	299	RMCOBOL 85 ANSI/ISO COBOL	1250	995	RMCOBOL UNIX or XENIX	1250	995
MPROLOG P550 by LOGICWARE	220	175	Source Software Query Utility for Blaise	245	220	RMCOBOL Run Time	250	195	RMCOBOL 85 RUN TIME	395	335
Prolog 86 from Solution Systems	125	Call	Code Sifter Protocol by David Smith	19	48	RMNET 5+ COBOL & COBOL 85 Network	300	249	SCREEN DESIGNERS		
Prolog 96 Plus from Solution Systems	250	175	Don Babin...UNIX Program Development	195	148	Panel Plus by Round Hill...no royalties New	495	395	View Manager for C by Binda	275	184
Turbo PROLOG by Borland Int'l	100	63	LMK from Lattice...make like UNIX	195	148	Vitamin C for Creative Programming	250	188	Windows for C Vermont Creative Software	245	218
Turbo PROLOG by Borland Int'l	100	63	Microsoft Windows Development Toolkit	500	385	Windows for C includes Windows for C	195	149	ZView Data Management Consultants	245	175
Turbo PROLOG Tools	100	64	ESSENTIAL PRODUCTS			TEXT EDITORS					
ASSEMBLERS & DEBUGGERS			C Utility Library			Briefview by File Managers	250	195	Brail from Solution Systems	195	Call
Advanced Trace 66 Morgan Debugger	175	119	Essential Graphics	185	118	Code by Emittering Tech...Multi-screen	195	159	Epsilon by Logica Software...like EMACS	195	149
C-Sprite Debugger by Lattice...source level	175	139	Essential Graphics	250	183	PinPoint by Sonata technology...C syntax	295	249	FirstTime by Sonata technology...C syntax	295	249
Microsoft Macro Assembler with Utilities	195	125	Essential Graphics	250	183	Kedit by Mansfield...similar to Xedit	125	99	LSL...The Lattice Screen Editor Multi Window	125	100
PASMB6 by Phoenix...Macro Assembler	195	125	Essential Graphics	250	183	Verdi by Logica Software	150	99	Verdi Plus by Computer	185	129
Parascope I Debugger...The Parascope Co	245	189	Essential Graphics	250	183	MODULA 2 LANGUAGE					
Parascope II with NMI Breakpoint Switch	115	115	Essential Graphics	250	183	MODULA 2 Apprentice Pkg by LOGITECH	99	79	C UTILITY LIBRARIES		
Parascope III X software only	145	105	Essential Graphics	250	183	Blaize C Tools					
Parascope III with Advanced Board...New	195	145	Essential Graphics	250	183	Blaize C Tools					
BASIC LANGUAGE			FILE MANAGERS			Blaize C Tools					
Microsoft BASIC Interpreter for XENIX	350	295	Briefview by File Managers	250	195	Blaize C Tools Plus	175	117	Blaize C Tools	125	84
Microsoft QuickBASIC Compiler 3.0	99	78	Brview Network by Solution Systems	595	485	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
BORLAND PRODUCTS			C-TREE by FileMan...no royalties, source			C Utility Library	185	139	C Food Source Toolz	100	87
Reflex & Reflex Workshop	200	129	C-TREE by FileMan...no royalties, source	395	329	C Build/Source Support by Lattice	150	109	C Build/Source Support by Lattice	150	109
Reflex Data Base System	100	64	C-TREE by FileMan...no royalties, source	395	329	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Reflex Workshop	70	45	C-TREE by FileMan...no royalties, source	395	329	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Turbo BASIC...New	100	64	C-TREE by FileMan...no royalties, source	395	329	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Turbo C Compiler...New	100	64	C-TREE by FileMan...no royalties, source	395	329	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Turbo Lighting	100	64	C-TREE by FileMan...no royalties, source	395	329	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Turbo Pascal & Turbo...New	125	85	C-TREE by FileMan...no royalties, source	395	329	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Turbo Pascal with 6086 & BCD	100	64	C-TREE by FileMan...no royalties, source	395	329	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Turbo PROLOG Compiler	100	63	C-TREE by FileMan...no royalties, source	395	329	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Turbo PROLOG Tools	100	63	C-TREE by FileMan...no royalties, source	395	329	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Turbo Turbo	40	28	C-TREE by FileMan...no royalties, source	395	329	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
C COMPILERS			FORTRAN LANGUAGE			C UTILITY LIBRARIES					
CBE Plus by Computer Innovations...New	497	387	FORTRAN Libraries...by Alpha Computer	70	45	Blaize C Tools Plus	175	117	Blaize C Tools	125	84
C Compiler C Compiler from Lattice	500	299	FORTRAN Libraries...by Alpha Computer	70	45	Blaize C Tools	125	84	Blaize C Tools	125	84
Lat's C Compiler by Mark Williams	75	55	FORTRAN Libraries...by Alpha Computer	70	45	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
with CSD Source Level Debugger	125	90	FORTRAN Libraries...by Alpha Computer	70	45	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Microsoft C Compiler by Microsoft	450	395	FORTRAN Libraries...by Alpha Computer	70	45	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Microsoft C Compiler 4.0	450	395	FORTRAN Libraries...by Alpha Computer	70	45	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Turbo C Compiler by Borland	100	64	FORTRAN Libraries...by Alpha Computer	70	45	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
C INTERPRETERS			GRAPHICS			C UTILITY LIBRARIES					
C-Trip by Gimpel Software	300	249	Essential Graphics	250	183	Blaize C Tools Plus	175	117	Blaize C Tools	125	84
Instant C by Rational Systems	500	395	GSS Graphics Development Toolkit	495	375	Blaize C Tools	125	84	Blaize C Tools	125	84
Interactive C by MIRA...with debugging	245	219	GSS Kernel System by Graphic Software	495	375	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
RUNIC Professional from Libeal	250	185	GSS Kernel System by Graphic Software	495	375	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
COMMUNICATIONS			Halo by Meridia Cybernetics			C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Asynch Manager by Brite...for C or Pascal	175	117	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
C UTILITY LIBRARIES			Halo by Meridia Cybernetics			C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Greenleaf Communications by Greenleaf	185	139	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
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Blaize C Tools	175	117	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Blaize C Tools	125	84	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Blaize C Tools 2	100	87	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
C Food Source Support by Lattice	150	109	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
C Utility Library by Essential...200 functions	185	139	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Greenleaf Functions by Greenleaf Software	185	139	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
COBOL LANGUAGE			Halo by Meridia Cybernetics			C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
RMCOBOL...New from Farland Prod	700	499	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
Microsoft COBOL Compiler	995	795	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
Micro Focus COBOL...see Micro Focus Prod			Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
JBASE SUPPORT			Halo by Meridia Cybernetics			C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
BRIEFVIEW...Brief for DBASE III	275	Call	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
CLIPPER...from Natvision	695	Call	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
MacMS...Call for MAC from Natvision	350	299	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
dbx...BASE to C translator by DESKTOP AI	350	299	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
with Library Source Code	350	299	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
with Full Source Code	1000	695	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
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with Full Source Code	1000	695	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
dbx...BASE to C translator by DESKTOP AI	350	299	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
with Library Source Code	350	299	Halo by Meridia Cybernetics	300	219	C Food Source Toolz	100	87	C Build/Source Support by Lattice	150	109
with Full Source Code	1000	695	Halo by Meridia Cybernetics	300	219	C Utility Library	185	139	C Build/Source Support by Lattice	150	109
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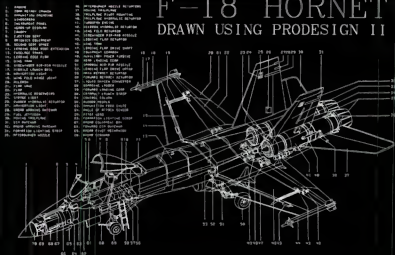
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■ LETTERS

like "most revolutionary" and "equally revolutionary" when referring to old concepts like recursion and binary file access might be dismissed by uninformed readers as the product of an enthusiastic writer. But to those people who have been following the "BASIC Wars," this is just pure hype.

Such "revolutionary" features as user-defined lower bounds of arrays, 8087 support, recursive subprograms/functions with true local variables, binary files, and SELECT/CASE structures have all been supported by True BASIC since 1985.

There are many things the Borland implementers can be proud of in Turbo Basic, but language design is not one of them. Many of the "new" features cited in Mr. Winer's review were defined in the American National Standard X3.113-1987, the BASIC standard that was finally approved this winter. And many PC Magazine readers realize that the newest features in Turbo Basic, QuickBASIC, and True BASIC come from that standard.

In addition, Mr. Winer cited the SELECT/CASE statement as an example of good language design, which he described as "lifted straight from Pascal." This statement is patently false: Wirth's Pascal does not allow closed or open ranges; if there is no case selected, the operation of the Pascal program is undefined. The design of this construct can better be attributed to the BASIC standards committee.

Mr. Winer is correct that the competition among the three major BASIC vendors will benefit the users of these products. However, biased reviews that ignore historical fact, the developing standards, and the competition will not.

Christian Walker

Vice President, True BASIC
Hanover, New Hampshire

Ethan Winer replies:

There is no doubt in my mind that Turbo Basic embodies many new features that are indeed revolutionary for BASIC. Though True BASIC does have SELECT/CASE and a limited form of binary file access, Turbo Basic provides these commands and more in a language that millions already know. Perhaps I should have said "revolutionary for a Microsoft-style BASIC."

But to me, the real issue is the emphasis you place on the ANSI definition of BASIC. While it's difficult to argue seriously against standards in the computer industry, I'm not convinced that the "committee" has come up with something worth adhering to. For example, the SE-

■ There is no doubt in my mind that Turbo Basic embodies many new features that are indeed revolutionary for BASIC.

LECT/CASE you cite forbids variables as part of the CASE comparison, which greatly diminishes its value. Borland decided to ignore that "standard," and in the process, has improved the language.

More to the point is how ANSI BASIC deviates from the standard that already exists, by needlessly replacing or eliminating many keywords. As far as I'm concerned, Drs. Kemeny and Kurtz dropped the ball years ago, and Microsoft is solely responsible for turning BASIC into the popular, easy-to-use language it has become. Microsoft is also to be congratulated for establishing \$99 as a reasonable price for a compiler and for removing additional runtime royalty payments.

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VIEWPOINTS

LETTERS



In "Behind the Screens: EGA and Multiscan Monitors," we ran an incorrect photograph for Princeton Graphic Systems' HX-12E monitor. The correct display is pictured here.

CORRECTIONS/AMPLIFICATIONS

Core's HC40 hard disk drive costs \$2,999 (First Looks, page 46, *PC Magazine*, Volume 6 Number 11).

The Princeton Graphic Systems EGA monitor pictured in "Behind the Screens: EGA and Multiscan Monitors" (*PC Magazine*, Volume 6 Number 6, page 122) is the HX-12, not the HX-12E as was stated. The HX-12E is pictured above.

The correct phone number for The Whitewater Group is (312) 491-2370 ("Windows Shopping: Applications for the Environment," *PC Magazine*, Volume 6 Number 11).

XWORD does not support Microsoft Word, Version 3.1 ("Word Processor Translation Software: Preserving the Formatted Page," *PC Magazine*, Volume 6 Number 12).

The correct list price of Keep It Simple Software's *dirWORKS* ("How to Handle Your Hard Disk," *PC Magazine*, Volume

6 Number 11) is \$40. Also, the correct phone number is (800) 543-KISS or (212) 764-KISS.

BACK TO BASICS

I would like to congratulate Mr. Ethan Winer for his reviews of QuickBASIC 2.0 (PC Lab Notes, *PC Magazine*, Volume 6 Number 1) and Turbo Basic (PC Lab Notes, *PC Magazine*, Volume 6 Number 9). Mr. Winer does not confine himself to general statements like "This BASIC is more powerful than the last version." Instead, he goes right to the point and demonstrates with plenty of examples how the new versions will ease your life as a programmer. Mr. Winer certainly appears to possess a thorough knowledge of the BASIC language, as well as practical programming experience.

Daniel Marc-Aurele
Montreal, Quebec
Canada

Ethan Winer's review of Borland's Turbo Basic reads more like a rewritten press release than an honest examination by an impartial critic (PC Lab Notes). Hyperbole

LETTERS TO PC MAGAZINE



LOOK-AND-FEEL: THE ARTICLE

The articles on the look-and-feel issue were hardly "out of character" for *PC Magazine* ("Taking the Stand: The Look-and-Feel Issue Examined," *PC Magazine*, Volume 6 Number 10). In fact, the

Next?" (*PC Magazine*, Volume 6 Number 10). It's the first genuine computer-related humor I've read in ages. I enjoyed it tremendously.

Peter A. McWilliams
Los Angeles, California

LOOK-AND-FEEL: THE ISSUES

The battle currently being waged in the computer press between Lotus and what seems to be the rest of the computer world is doing nothing to improve the image of the industry. Had Lotus not upgraded 1-2-3 to Release 2.0 and abandoned compatibility with its earlier version, it could have justifiably told us that Mosaic Software and Paperback Software were infringing upon its market. Instead, a company whose own product was derived from an earlier product has the gall to harass two companies for doing the same thing.

Bernard Barston
Fairfax, Virginia

I have to disagree emphatically with Winn L. Rosch's opinion that "increased copy-right protection afforded [programmers] should give them more monetary incentive to pursue creative work" ("The Copyright Law on Trial," *PC Magazine*, Volume 6 Number 10).

Large companies such as Lotus, given this absolute protection, would have no motive to improve their product. Innovators would be forced to reinvent the user interface instead of offering evolutionary versions of the familiar Lotus interface. Finally, users would have to choose between buying overpriced nonevolutionary software and wasting time learning new command structures.

I believe innovation and improvement should be encouraged, not stifled by the le-

gal clout of rich companies. If Lotus wins, other companies will doubtless hire hordes of lawyers to descend on those who dare to improve the ideas of others.

Bill Baker
Saskatoon, Saskatchewan
Canada

In trademark law, if a trademark is so extensively used as to describe all products in its class, it becomes generic and the owner loses his right to it. By the same token, if a human-computer interface becomes so widely used as to be accepted as the normal way to communicate with the machine, it too should become generic for the benefit of the public.

Izak G. Zycer
Santiago, Chile

With so many innovative people at Lotus, one would think the company could have found a better way to resolve the look-and-feel issue. Surely Lotus could have resorted to an approach short of a lawsuit that,

■ Innovation should be encouraged, not stifled by the legal clout of rich companies.

win or lose, is bound to bring the company ill will and have an unsettling effect on the development of all kinds of software for years to come.

Stan Siron
Lincoln, Nebraska



issue was completely in keeping with what I have come to expect from your publication: accurate and timely coverage of developments in the field of IBM-standard personal computing. It would have been out of character for *PC Magazine* to have dropped a paragraph about the controversy into a column without giving it the same thorough coverage as Comdex, copy protection, LANs, or any other topic of immediate concern to users. And so I repeat: In character, Mr. Machrone. Eminently in character.

Oscar J. Zuniga, Jr.
McAllen, Texas

Regarding the articles on the Lotus look-and-feel issue ("Taking the Stand: The Look-and-Feel Issue Examined"): the best chuckle was the blurb on the cover of the magazine: "Free Lotus-Style Menu for All Your Applications."

Bob Palowoda
Fremont, California

I would like to thank Stephen Manes for his article "Who'll Think of Suing What

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Karl Koessel PC World
December 1986

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What is the smaller of the islands in the Seine.

I'll be St-Louis.



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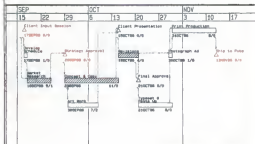
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WHAT'S INSIDE

This month's cover story was a long time coming. We began researching it just after Compaq's 386 introduction last September, when it seemed like every computer company known to man (and a few that weren't) began crowing about their own imminent super-PCs.

But every time we geared up to do the story, all these fabulous new machines were suddenly not quite ready for prime time. It wasn't until midsummer that we rounded up enough real, working 386s to bring you the in-depth survey that begins on page 91.

Our patience was finally rewarded with a truly impressive crop of 386 machines, including PC's Limited's record-breaking 16-MHz machine and the PS/2 Model 80 from IBM.

We also went to some lengths (and distances) to get a sneak preview of Tandy's 386 offering, the 4000 HL. Associate editor Nora Georgas got to know Fort Worth pretty well while supervising testing and photography of the 4000 at Tandy HQ. It was a tough job, but someone had to show those Texans that Yankees can roll a mean fajita.

Of course, when it rains, it pours, and by the time this issue hits the stands, there will be another dozen 386s to review. We'll have a look at them in our December 22 edition.

This issue we also bring you a great new utility. DOS 2.0 made it possible to sort your files into subdirectories, but the tools it provided for leading subdirectories were just plain awful. Contributing edi-



Life in the fast lane: associate editor Nora Georgas headed up this issue's coverage of 386 computers.

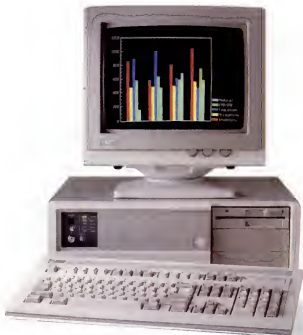
tor Michael J. Mefford has fixed that with this issue's sensational free utility, RN.COM.

Built to work with his earlier programming gem, DR.COM (get it? DR is doctor; RN nurse), RN gives you the standard DOS tools but adds a visual representation of your subdirectory tree structure, makes it a snap to move from directory to directory, provides file counts, and a whole lot more. It lets you hide a subdirectory, rename it, or make all the files in it read-only so they can't be erased. And it lets you remove a directory and all the files in it with one confirmed keypress. You can make RN memory resident and instantaneous or run it as a nonresident program to avoid conflicts and save RAM. If you have a hard disk, put RN onto it as quickly as possible.

Finally, you'll notice our new masthead page. Besides listing the staff, the page tells you how to get in touch with us if you've got a new product or if you have a question about your subscription. There are also instructions for calling the PC Magazine Interactive Reader Service. ☐

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AST Premium/286 (10/0)	2.25	1.41	2.12
IBM PC AT (6/1)	1.00	1.00	1.00
IBM PC XT-™/286 (6/0)	1.32	1.33	1.03
IBM PC AT (8/1)	1.37	1.17	1.40
IBM PS/2 Model 50 (10/1)	1.71	1.70*	1.19*
IBM PS/2 Model 60 (10/1)	1.72	2.02	1.67

*With RAM cache: seq. 1.92, ran. 1.03

Source: InfoWorld Hardware Benchmark System, as published in InfoWorld May 11, 1987

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HEAVY METAL

386s Weigh In

If personal computers based on Intel's 80386 microprocessor had feet, they'd make the Sea of Galilee their walkway. Anyplace computers are discussed, the 386s have been praised almost to the point of being canonized.

Indeed, the litany of their virtues is lengthy: 80386-based PCs just start to stretch their legs at a clock speed of 16 MHz long after other machines have run out of gas. They shuffle data 4 bytes at a time, deal directly with 4 full gigabytes, and can pretend 64 terabytes (that's trillions of bytes) are their own. And they need not bother with the bane of every programmer, the 64K segment limit suffered by previous PCs.

The differences between the 8088- and 80286-based machines of yesteryear and those driven by the 80386 are both quantitative and qualitative. Unlike the 8088, the 80386 was designed from the beginning to run MS-DOS—but not just one applica-

tion at a time. Inherent in its 275,000 transistors, the 80386 microprocessor has hardware multitasking capabilities. It can run several DOS and non-DOS applications concurrently and never lose a byte.

The 80386 is Intel's first mainstream offering that can both operate with huge contiguous fields of data and slice itself up into multiple 8086 sessions. On the one hand, its architecture can mimic the cream of today's mini- and mainframe computers with vast virgin territory in which huge programs can unfold. On the other, it can duplicate the efforts of more than half a dozen ordinary PCs, all running in one box simultaneously.

Total everything up and you have the power user's dream come true. The potential performance of the 80386 chip—3 to 4 million floating-point operations per second (or MIPS)—puts computers based on it in the same class as larger VAX mini-computers. That's power enough for com-

*After a year of hype, the 386s
are here in force. And they're just as fast and
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puter-aided design, desktop publishing, statistical analysis, and real-time 3-D animation—let alone such mundane chores as manipulating spreadsheets, sorting through databases, and processing words. The 80386-based PC truly puts mainframe power on your desktop.

Buy one of today's many 80386-based PCs, however, and you may be disappointed. It probably won't be as fast as all the hoopla has led you to believe. And all those revered multitasking features, for the most part, lie dormant.

Perhaps that's to be expected. No mere machine could live up to the miracles attributed to the first of the 80386-based PCs. Like saints, these machines may be appreciated only in retrospect.

In truth, the weakness of the 80386 chip and computers based on it are the same as those of any other new chip. The 80386-based PCs are still machines ahead of their time. The world still lacks software that can take advantage of all their intrinsic power.

SHORT STEP When confronted with existing DOS applications, the performance of the 80386-based PC is simply shocking, erring in the direction of unfulfilled expectations. While the generational step from the 8088 to the 80286—led by IBM's introduction of the PC AT—boosted system performance by more than a factor of five, the improvement won by the much-heralded 80386 amounts to little more than twofold at best. At first glance, the supposed quantum leap afforded by the 80386 microprocessor is just another ordinary step.

The crux of the problem is in the operating system: DOS uses the 16-bit instruction set of the 8088, 8086, and 80286. When the 80386 is confronted with 16-bit instructions, it operates just like one of the earlier chips, matching the AT's 80286, instruction for instruction.

Even though DOS cannot take advantage of the full 32-bit instruction set of the 80386, the new chip is designed for high operating speeds. So with 16-bit instructions executing at 16 MHz (everyone seems to have ignored the 12.5-MHz version of the 80386 that Intel has also announced), the 80386 will crunch through numbers twice as fast as an AT.

A CLOSER LOOK AT THE SUPERCHIP

The 80386 microprocessor has more going for it than just 32 bits. Its unique architecture marks machines made from it as mightier than most minicomputers while lightening the load on programmers.

The heart of any microprocessor is its registers, where actual computations take place. Previous PC microprocessors from the 8088 to 80286 have used 16-bit registers; eight registers of the 80386 are double that width, so they can work with twice the information in the same time.

In addition, these registers can function as pairs of 16-bit registers to copy perfectly the commands of earlier processors. Further, four of the 80386 registers can be manipulated 8 bits at a time, taking such compatibility down to the basic level.

Besides having a 32-bit data path, the 80386 has 32 bits of addressing so it can directly manipulate 2^{32} bytes of memory, a total of 4 gigabytes. In addition, it is designed to handle virtual memory—that is, it can swap bytes from RAM to disk to make programs think it has more RAM at its disposal than really exists—up to 64 terabytes, or 64 trillion (2^{40}) bytes.

The 80386 does not manage this virtual memory by itself. It must work together with a disk operating system, which, in turn, must be written to take advantage of this feature.

Incorporated into the design of the 80386 is a feature called pipelining, which allows different internal modules of the chip to operate concurrently to speed up its operations further. For instance, a special prefetch cache allows the microprocessor to hold 12 bytes of memory (such as the next three 32-bit instructions) in a special buffer that makes

the code almost instantly available. This pipelining also allows the 80386 chip to address memory at the same time as it is executing an instruction.

Just as with the earlier 80286, which had two operating modes, real and protected, the 80386 has three modes. The first two are the same as those of the 80286, and the third is "virtual 86" mode in which the 80386 can act like one or more 8086 chips (or PCs based on them) that are independent and isolated from one another.

In addition, the 80386 has many internal features that facilitate multitasking operations, including four levels of privilege, privileged instructions, a system of access rights, and the ability to segment tasks.

Unlike other Intel chips that break their address ranges into fixed segments, the 80386 allows dynamic segmenting unbound by the 64K-byte limit of the 8086 and 80286. Segments for the 80386 can be as large as 4 gigabytes or as small as a few bytes.

Most importantly, the instruction set of the 80386 is a superset of that of the 80286, so older code will run on the chip without a hitch. It also has its own powerful 32-bit instruction set.

All of these features are implemented with a special low-power, high-speed fabrication process called CHMOS, which helps the chip achieve its 12.5- or 16-MHz internal clock speed.

The net result of the combination of all of these features is that the 80386 does a whole lot more than its predecessor did, and it does it better and faster. So much so, in fact, that most PC users may not discover its true power for the next couple of years.—Winn L. Rosch

Upcoming versions of the 80386 chip will extend its top speed to 20 MHz and possibly 24, all with commensurate performance improvements.

As a consequence, even with new com-

puters based on it flooding the market, the 80386 remains a microprocessor of possibilities. Today all it seems to grant the systems using it is the very visible and valuable benefit of speed.

A little further into the future, however, new software will latch on to another of the powers of the 80386: multitasking. The 80386 makes easy what programmers have wracked their brains trying to accomplish for the last five years—doing more than one thing at a time on an MS-DOS personal computer. The 80386 makes that kind of programming child's play—at least for children with experience in assembly language programming.

When the 80386 handles multiple DOS applications, each one is isolated and won't intrude on the others, yet all tasks can share the same resources and files. Because this feature is implemented in hardware, the programmer doesn't have to fret about the details.

In the more distant future, new operating systems (should they ever become reality) will turn the desktop 80386 (and the desktop 80286 as well) into a scaled-down mainframe, able to handle the same applications with agility.

SPEED KILLS The first 80386-based PC, the Compaq Deskpro 386, was announced in September 1986, but most manufacturers have only recently released machines that use the chip. The reason is not that computer makers doubt the superiority of PCs based on the 80386 but that developing such systems is fraught with difficulties.

The biggest problems inherent in designing a computer based on the 80386 revolve around the high speed at which the chip operates. A 32-bit microprocessor running at 16 MHz demands more speed than most memory chips are able to handle. As a result, the 80386 often has to stop and wait for the memory to catch up. These wait states eat away at the performance the fast clock speed is supposed to achieve.

The current crop of 80386-based PCs embody several design techniques to match memory to microprocessor. Adding wait states is the most straightforward method and represents the technique used by all the manufacturers in this group with the exception of Acer, Chicago Computer Connection, and PC's Limited.

Another technique is the brute force method—simply upgrading all of the RAM in the system so that it can handle the

NEW COPROCESSORS FOR A NEW ERA

A coprocessor is aptly named. A short, companion, and coconspirator of the microprocessor, the coprocessor is designed to handle specialized duties with the utmost dispatch.

Unlike the microprocessor, which is designed to be a general-purpose device, the coprocessor is optimized for one particular task, such as crunching numbers or drawing pictures. This specialization earns the coprocessor a high speed rating. Once equipped with a coprocessor, a computer can complete its job much faster than it could with an ordinary microprocessor alone.

In general, coprocessors use their own microcode instructions (passed to them through the main processor), operate independently of the main processor, and only share raw data and results with the main processor.

Probably most famous is the numeric coprocessor, and the most popular of these in the Intel family are the 8087, 80287, and 80387. These chips are designed to carry out floating-point mathematical operations very quickly.

A numeric coprocessor best speeds up programs that rely on many mathematical calculations. Hardly coincidentally, these applications are generally those that make the best use of an 80386 computer—for instance, CAD, desktop publishing, high-resolution graphics, and scientific calculations.

The performance improvement won by adding a coprocessor to an 80386 system is so great and the cost so nominal (even at \$795 for a coprocessor chip) that not adding a coprocessor is often foolish—provided, of course, that the soft-

ware you plan on using is written to take advantage of a numeric coprocessor.

The 80386 microprocessor is compatible with both the 80287 and 80387 numeric coprocessor chips, and the new 80387 is generally compatible with the instructions used by 80287. Both coprocessors, for instance, have 80-bit registers to handle their mathematic operations. Either of the two chips can execute coprocessor code of most of today's DOS applications.

Although the two chips operate similarly, they are not directly compatible. An 80387 won't fit into an 80287 socket, and vice versa. When adding a coprocessor, you must use the chip that the computer was designed for.

Most early 80386-based PCs were designed to use with the 80287 coprocessor, primarily because that chip was available and the 80387 was not. In addition, 80287 chips, priced between \$295 and \$490, are cheaper than their 80387 rivals.

In the 80386 environment, however, the 80387 coprocessor is the best—and speediest—choice. The two chips were designed to work together, and the 80387 handles the same high speeds as the 80386, up to 16 MHz currently.

The 80287 comes in several speed ratings, from 5 to 12 MHz, with faster chips being more expensive. In any computer, the coprocessor you install must have a speed rating as high or higher than the clock frequency the computer circuitry uses for driving the coprocessor chip. Usually, this frequency is different from that clock frequency used by the main microprocessor.—Winn L. Rosch

quick pulse of the 80386 without wait states. So far, only PC's Limited has opted for this strategy, equipping all of its systems with nothing but high-speed static RAM, at a cost per byte roughly double that of the more-common (and slower) dynamic RAM.

Instead of filling its whole machine with fast static RAM, Compaq opted for a different kind of memory in its Deskpro 386. Compaq used static-column dynamic RAM, which divides memory into 2K pages that each work like purely static RAM. After the first access to a page, sub-



80386-Based PCs: Summary of Features

(Products listed in ascending base price order)

BASE PRICE INCLUDES

	Base price	RAM	Floppy disk drives	Hard disk drives	Clock/calendar	Software	Monitor	Ports	Slots	Power supply (watts)	Reset key	Keyboard style
ALR 386/2 Advanced Logic Research Inc.	\$1,990	2 Mbytes	1 1.4-Mbyte	None	●	None	○	1 serial, 1 parallel	2 32-bit 4 16-bit 2 8-bit	200	○	IBM Enhanced
Tandy 4000 Tandy Corp.	\$2,599	1 Mbyte	1 1.4-Mbyte	None	●	DOS, GW-BASIC, Personal Desktop, The Monitor	○	1 serial, 1 parallel	1 32-bit 6 16-bit	192	●	IBM Enhanced
CCC-386c Chicago Computer Connection	\$2,995	1 Mbyte	1 1.2-Mbyte	None	●	None	○	1 serial, 1 parallel	1 32-bit 5 16-bit 2 8-bit	200	●	Original AT
PC Discount Noble 386 PC Discount	\$2,999	512K	1 360K	20-Mbyte	●	MS-DOS 3.1	●	1 serial, 1 parallel	1 32-bit 3 16-bit 2 8-bit	220	○	IBM Enhanced
CCI 87/386 Computer Classifieds Inc.	\$3,195	640K	1 1.2-Mbyte	40-Mbyte	●	None	●	2 serial, 1 parallel	1 32-bit 3 16-bit 3 8-bit	200	●	IBM Enhanced
Acer 1100 Acer Technologies Corp.	\$3,995	1 Mbyte	1 1.2-Mbyte	40-Mbyte	●	MS-DOS 3.2, GW-BASIC	○	2 serial, 1 parallel	1 32-bit 3 16-bit 2 8-bit	196	●	IBM Enhanced
Laser Digital Proser 386 Laser Digital	\$4,095	512K	1 1.2-Mbyte	40-Mbyte	●	MS-DOS 3.2, disk caching	●	1 serial, 1 parallel	2 32-bit 4 16-bit	192	●	IBM Enhanced
Kaypro 386 Kaypro Corp.	\$4,495	512K	1 1.2-Mbyte	None	●	MS-DOS 3.2, GW-BASIC, Speedstar	○	1 serial, 1 parallel	2 32-bit 4 16-bit 2 8-bit	215	○	IBM Enhanced
PC's Limited 386-16 PC's Limited	\$4,499	1 Mbyte	1 1.2-Mbyte	40-Mbyte	●	None	●	2 serial, 2 parallel	1 32-bit 3 16-bit 2 8-bit	200	●	IBM Enhanced
Compaq Deskpro 386 Compaq Computer Corp.	\$6,499	1 Mbyte	1 1.2-Mbyte	40-Mbyte	●	None	○	1 serial, 1 parallel	1 32-bit 4 16-bit 3 8-bit	192	○	IBM Enhanced
Corvus 386 Corvus Systems Inc.	\$6,595	512K	1 1.2-Mbyte	None	●	None	○	1 serial, 1 parallel	2 32-bit 4 16-bit 2 8-bit	200	●	Original AT
IBM Personal System/2 Model 80 IBM Corp.	\$6,995	1 Mbyte	1 1.44-Mbyte	44-Mbyte	●	None	○	1 serial, 1 parallel, 1 mouse, 1 video	3 32-bit 8 16-bit	225	○	IBM Enhanced

PC — Indicates Editor's Choice ● — Yes ○ — No

sequent accesses to that same memory page can be made without wait states. Most programs execute within a 2K page, so overall system performance is boosted to near what it would be if system RAM were entirely static.

Tandy and Acer Technologies opt for a technique called memory interleaving. When Tandy's Model 4000 is equipped with 1 megabyte of RAM, it operates conventionally by adding wait states. When the Model 4000 is equipped with 2 megabytes of dynamic RAM, however, its memory accesses alternate between banks of chips, interleaving the requests for data, so no wait states are required and performance increases. Acer accomplishes the same interleaving with 1 megabyte of memory by using 4- by 64-kilobit chips.

BAD VIBES Another speed-related problem faced by designers of systems based on the 80386 is radio frequency interference. The higher a computer's clock frequency, the harder it is to contain its radiation inside the computer's case and the more difficult it becomes to make the computer pass Federal Communications Commission emission requirements. All computers must be certified by the FCC if they are to be sold.

The FCC grades equipment in two categories: Class A, which applies to business equipment and is the less stringent classification; and Class B, which applies to devices used in the home and is the stricter standard. While most personal computers now are Class B rated, the majority of the latest 80386-based PCs meet only the

Class A emission level. Among the computers reviewed here, only three—the Acer 1100, the Kaypro 386 Model E, and the PC's Limited 386-16—have Class B certification.

Even getting to the Class A standard with 16-MHz operation has proved challenging. (The clock signals inside a 16-MHz computer are actually 32 MHz because the 80386 chip itself divides the incoming clock speed in half to achieve its rated speed.) Many of the computers reviewed here had every chassis opening larger than a pencil-width plugged with metal to keep the interference inside the case.

In fact, several of the machines examined here bore no FCC approval sticker and certification number. Until they

CONFIGURATION TESTED		SPECIFICATIONS					OTHER		
Price	Configuration	Clock speed (MHz)	Controller card handles	32-bit memory	Math coprocessor	RAM chips	IBM EGA compatible	Warranty	BIOS manufacturer
\$5,088	40-Mbyte hard disk drive, EGA system	16	2 floppy and 2 hard disk drives	Proprietary slot	80287, 80387	DRAM	●	1 year	Phoenix
\$5,997	40-Mbyte hard disk drive, EGA system	16	2 floppy disk drives	Proprietary slot	80387	DRAM	●	90 days limited	Phoenix
\$3,673	40-Mbyte hard disk drive, amber monitor/card	16	2 floppy and 2 hard disk drives	Motherboard	80287	DRAM	●	1 year limited	Phoenix
\$8,139	20-Mbyte hard disk drive, 1.2-Mbyte floppy disk drive	16	2 floppy and 1 hard disk drive	Proprietary slot	80387	DRAM	●	1 year	Phoenix
\$3,695	40-Mbyte hard disk drive, 3 Mbytes RAM	14.2	2 floppy and 2 hard disk drives	Proprietary slot	80287	DRAM	●	1 year limited	Phoenix
\$4,895	40-Mbyte hard disk drive, EGA monitor	16	1 floppy and 1 hard disk drive	Proprietary slot	80287, 80387	DRAM	●	1 year limited	Award Software
\$5,506	40-Mbyte hard disk drive, EGA monitor, 80287 coprocessor	16	2 floppy and 2 hard disk drives	Proprietary slot	80287	Static and DRAM	●	1 year limited	Phoenix
\$6,715	40-Mbyte hard disk drive, EGA monitor	16	2 floppy and 2 hard disk drives	Proprietary slot	80387	DRAM	●	1 year limited	Phoenix
\$6,499	40-Mbyte hard disk drive, EGA monitor	16	2 floppy and 2 hard disk drives	Proprietary slot	80287	Static	●	1 year limited	PC's Limited
\$7,897	40-Mbyte hard disk drive, EGA monitor	16	4 half-height devices	Proprietary slot	80387	Static-column DRAM	●	1 year	Compaq
\$15,075	70-Mbyte hard disk drive, 380K floppy disk drive, 2-Mbyte RAM expansion card, tape cartridge backup system	16	2 floppy and 2 hard disk drives	Proprietary slot	80387	DRAM	●	1 year	Cervus
\$9,275	70-Mbyte hard disk drive, 2-Mbyte floppy disk drive, 12-inch VGA monitor, mouse, DOS 3.3	16	3 floppy and 2 hard disk drives	Proprietary slot (Micro Channel)	80387	DRAM	●	1 year	IBM

achieve such certification, this equipment cannot be legally sold.

CROWDED BUS Computers based on the 80386 microprocessor are different from all previous PCs in another way. The 386 PCs were designed without the guidance of a previous IBM model to lead the way. Although all of these machines copy the vital elements of the AT, including using its 16-bit bus for most of their expansion slots, they had no such prototype to duplicate for their 32-bit memory expansion area.

As a consequence, nearly every manufacturer of 80386-based PCs has designed its own 32-bit expansion bus and, with one exception, 32-bit boards from these computer models will not be compatible with

those of any other model. A Compaq board will not fit in a Tandy or PC's Limited, notwithstanding that all three computers are made in Texas.

The exceptions are those that use an Intel-designed proprietary 32-bit expansion bus. Several manufacturers of 80386-based PCs follow this standard—and with one very good reason. All of these supposed computer makers base their products on a system board that is sold to OEMs (Original Equipment Manufacturers) already complete—designed and manufactured as a piece by Intel. Because these computers all use the system board, they are essentially the same computer under the skin and naturally accept the same 32-bit expansion boards.

The Intel board holds one big benefit

for the manufacturers—it helps them create instant computers. About the only expertise needed to make a computer from it is the ability to turn a screwdriver. Even famous-name manufacturers, such as Kaypro, have opted for the quick results won by using the off-the-shelf system board. Others include Laser Digital, Corvus, and PC Discount.

For you, as an end user, the lack of a standard 32-bit bus is not yet an issue. No standard expansion board currently makes use of a 32-bit data path. The only expansion that you're likely to require with 32-bit architecture is adding memory. All manufacturers of 80386-based PCs offer their own memory expansion boards that take advantage of 32-bit architecture.

Certainly this situation may change, but

BUG LEADS TO 80386 SHORTAGE

Odds are that you'll have more than the usual amount of difficulty finding an 80386 computer to buy. The problem is not a lack of announced models or too few manufacturers making the machines, but a severe chip shortage.

Just as Intel was ramping up its supply to meet a demand estimated between 500,000 and a million chips this year alone, word leaked out about a particularly insidious and transitory bug that afflicts perhaps as many as 60 percent of the 80386 chips shipped from Intel before April 14.

Intel has taken preventive action since then, checking all outbound chips for the bug and even redesigning the 80386 chip itself. However, any such redesign takes time (as does testing). As a result, the flow of high-performance silicon from Intel virtually dried up earlier this summer, and high-volume deliveries of the exciting chip are not expected until later this year. The unexpected redevelopment work has also delayed the marketing of the already announced 20-MHz version of the 80386.

Most people won't be bothered by the bug that may afflict early 80386s. According to Intel, only 1 percent of the ailing 80386 chips demonstrate any problem when using 16-bit instructions. DOS, of course, uses only 16-bit instructions.

The problem may occur in as many as 60 percent of the early chips when they execute 32-bit instructions to multiply. In other words, any given 80386-based computer may work fine while the DOS standard prevails but give erroneous answers when 32-bit operating systems are used.

Most manufacturers and Intel now verify that the bug does not occur in chips installed in products they ship. Consequently, if you have recently bought an 80386-based computer or have not yet bought one but are planning to, you're safe.

The shortfall of the 80386 supply may just keep you waiting a while longer for the machine you want. But you can still be sure that it will be worth waiting for. —Winn L. Rosch

until peripherals can transfer data faster than the 16-bit data path can handle, 32-bit expansion is not an issue.

INVESTMENT STRATEGY The obvious question is whether the 80386-based PC is a good investment now or would waiting a while for software and prices to come down be a better strategy.

It's only the people ordinarily most jaded—the accountants and other cost-control experts—who put their fingers on the instant value of the new generation of desktop computers. Twice as fast is nothing to sniff at. After all, if you can double the output of a \$50-an-hour engineer, the 80386 machine pays for itself in the first two months. The "mere" twofold improvement pays important dividends.

Certainly a number of 80286-based computers approach the performance level of an 80386 running current versions of DOS. But investing in one of those 80286

machines may not be the best long-term investment, especially if some software developers sit out the OS/2 explosion and wait for a future "80386-only" operating system to arrive.

The 80286 is dead-end technology. The 80386 is the architecture of the future. Although its benefits are modest today, tomorrow it will change the personal computer and how you use it.

If you buy a PC based on the 80386, you should never have to say you're sorry—to your accountant, banker, or budget committee. The risks are slight, and there's power aplenty waiting to be tapped, now and even more in the future.

Hands-on reviews of 12 80386-based PCs follow. They encompass a wide range of prices and manufacturers, including Acer, ALR, Chicago Computer Connection, Compaq, CCI, Corvus, IBM, Kaypro, Laser Digital, PC Discount, PC's Limited, and Tandy.

ACER TECHNOLOGIES CORP.

Acer 1100

Although Acer is a new name among personal computers, the novelty is on the label only. A new distribution arm of Multitech Electronics, Taiwan's largest PC maker, Acer Technologies Corp. carries on that company's tradition of quality and value-packed products.

The Acer 1100, the company's first 80386-based offering, is basically derived from the AT school of styling. The case matches that of IBM's original AT in size, shape, and layout.

Five 5¼-inch, half-height drive bays are provided, two in an internal double-stack and three with their faces on the right. Although the bays use proprietary drive-mounting hardware, Acer includes two extra sets of installation rails with each system to make installing the peripheral of your choice easy.

The buff-colored machine is quite stylish, with a sculpted control panel on the left—complete with flat keylock and system speed and drive activity indicator LEDs—and ribbing to break up its otherwise blank face.

The keyboard plugs into the rear panel, as does an incoming power cord and outgoing switched AC line to run a display. The power switch for the 195-watt supply



FACT FILE

Acer 1100

Acer Technologies Corp.
401 Charcot Ave.
San Jose, CA 95131
(408) 922-0333

List Price: With 40-Mbyte hard disk drive, 1.2-Mbyte floppy disk drive, 1 Mbyte RAM, enhanced keyboard, clock/calendar, \$3,995; same configuration with monochrome monitor, \$4,495; with EGA monitor, \$4,895; 80-Mbyte hard disk drive configuration, \$4,995 without display, \$5,495 with monochrome monitor, \$5,895 with EGA monitor; 130-Mbyte hard disk drive configuration, \$6,895 without display, \$7,395 with monochrome monitor, \$7,795 with EGA monitor.

In Short: Zero-wait-state performance puts the solid Acer 1100 near the top in PC Labs benchmark tests.

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1. Designed for the 80386

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In designing PC-MOS, we knew our first priority was to exploit the minicomputer capabilities of 80386-based PCs & PS/2s. But we went further, and developed a system which would be fully existing PCs, PC ATs, and sacrifice. You'd expect

4. Thousands of DOS Programs PC-MOS/386™ gives you the best of the past, and the best for your future. Which means that while PC-MOS/386™ totally replaces your old DOS, you won't have to replace the programs you've spent a lot of time learning.

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Think of it! Programs like dBASE III, WordPerfect, Lotus 1-2-3 and Symphony, WordStar, MultiMate...literally thousands of DOS programs—all compatible and multi-user available.



5. Familiar Commands Like DIR and COPY

Just as you don't have to learn a whole new array of software to take advantage of PC-MOS/386™ neither do you have to learn an entirely new set of commands.

Instead, the system builds on the knowledge you already have. "COPY" still copies files, and "DIR" still gives you a directory listing. As you might expect, we didn't stop there. There's a wealth of features that have strengthened the commands you know, making them more powerful and easier to use.



3. One, Five, Up to Twenty-five Users

From the beginning, PC-MOS/386™ was designed as a versatile operating system which could support twenty-five users as easily as it supports one. The system comes in single, five, and 25-user modules, so you're able to start with what you need and expand when you're ready.

In a multi-user setting, PC-MOS/386™ uses the computing power of the host PC to drive workstations linked to standard RS-232 ports.



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of Users Will Choose PC-MOS/386™

6. Concurrently Supports Virtual 8086 and 80386 32-Bit Mode



80386-based PCs & PS/2s are dual-personality computers. To run DOS programs, they act as PCs with a 640K memory limit. But to take advantage of their minicomputer capacity, they operate in true 80386 mode which lets them address up to four gigabytes of memory. PC-MOS enables the 80386-host and its workstations to independently switch between these modes—making DOS compatibility and 80386 power simultaneously possible.

7. Multi-Tasking

While it's true you could look elsewhere for multi-tasking, why would you want to? The *other* multi-tasking operating system is not now, nor is it planned to be, multi-user. It won't even run multiple DOS applications in multi-tasking mode.

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When you decide to implement either a network or a multi-user system, there's a two-fold problem which must be solved: protecting your work from accidental misuse and securing it from intentional theft.

PC-MOS/386™ solves both aspects of this problem. Password protected security allows you to assign file, directory, and task access to each user. Plus, files and records are locked using either PC-MOS' proprietary system or NETBIOS emulation.

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It's been said that information is power...which makes PC-MOS/386™ a deadly weapon to your competition. Imagine on-the-road salespeople being able to file call reports and access your latest inventory data. Picture executives being able to access your corporate database from across the country, or around the world—giving them the information they need, when they need it.

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10. The Price...As you evaluate operating systems, ask yourself if it's reasons you're considering...or rhyme. Ask if you're getting a system for tomorrow, or one that was made for yesterday. See if you're being forced to buy new hardware because of *their* software.

And consider this.

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► It's not just the zero-wait-state performance of the Acer 1100 that commends it. Its standard keyboard, for instance, which duplicates IBM's 101-Key Advanced Keyboard layout, proved to be one of the most likable of any compatible. Our evaluation unit, pictured above, bears the labels of Multitech, Acer's parent company.



is also hidden on the rear panel.

The interior of the machine is cleanly laid out in an entirely conventional fashion, with the bottom of the case lined by Acer's proprietary system board.

The board features eight expansion slots—two 8-bit, five 16 bit, and one proprietary 32 bit. All slots are full length and tall enough to accommodate full-size AT expansion cards. In the minimal configuration that Acer offers, three slots are filled: one 8-bit with an optional four-function (MDA, Hercules, CGA, and EGA) graphics card; a communications adapter with one parallel and two serial ports in one 16-bit slot, and a Western Digital WD-

1003 combined floppy-and-hard-disk controller in another.

The communications adapter uses a standard female DB-25 connector for its parallel port, an AT-style male DB-9 for COM1, and an XT-style male DB-25 (on a separate mounting bracket) for COM2.

The microprocessor is, of course, an 80386 operating at its rated maximum speed of 16 MHz with zero-wait-state memory based on interleaved memory. A special program supplied by Acer allows the system to operate at lower speeds for compatibility with unruly software. The speed selections include 16, 12, 10, 8, 6, and 4.77 MHz.

Acer makes provisions for adding either an 80287 or 80387 numeric coprocessor, selectable by a system board jumper.

Standard memory is 1 megabyte, arrayed in four banks of eight 4-by 64-kilobit dynamic RAM chips and one bank of 1-by 256-kilobit dynamic RAM chips (for parity checking). All memory is socketed and rated at 100 nanoseconds. This unusual memory arrangement allows Acer to interleave memory in 256K banks and achieve zero wait states. It also earns the Acer an overall performance rating near the top of the list, second only to the PC's Limited 386-16, which also uses static RAM.

The single 32-bit expansion slot allows up to 16 megabytes to be installed in the Acer 1100 using proprietary memory boards. It is not downwardly compatible with 8- or 16-bit expansion cards.

UNUSUAL MEMORY The Acer memory rates as unusual, too, in that only 896K of it is useful in its standard configuration—640K for DOS and 256K for extended. (Acer provides a driver to emulate EMS in extended memory.) To further enhance system performance, the Acer 1100 reloads its BIOS into the missing RAM for high-speed execution. The Acer BIOS itself bears an Award Software copyright.

All Acer 1100 units are equipped with one 1.2-megabyte, high-density, 5¼-inch floppy disk drive, and all feature some kind of hard disk. The bottom-of-the-line system, which was received for evaluation, was equipped with a full-height, 40-megabyte Miniscribe hard disk that uses a standard ST-506 interface and turned in a commendable 24-millisecond average access time. Hard-disk options also include 80- and 130-megabyte models. Storage Dimension's *SpeedStor* installation and diagnostic package is included for managing these hard disks.

The disk-loaded setup procedure includes support for 23 hard disk drive types. Configuration information is stored in nonvolatile CMOS memory that's kept powered up by a 3.8-volt lithium battery attached with Velcro inside the rear panel of the chassis. The battery also powers the Acer 1100's internal clock.

The standard Acer keyboard (labeled "Multitech" on the evaluation sample) duplicates IBM's 101-key Advanced Key-

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■ 386 COMPUTERS

board layout. It proved to be one of the most likable and usable keyboards of any compatible, featuring both tactile and audible feedback, as well as a light, but positive, feel.

In addition to MS-DOS 3.2 and GW-BASIC, Acer includes extensive, clearly written documentation with the 1100, including the DOS and BASIC manuals, a large user guide, and several pamphlets of introductory materials. The Acer 1100 has also received FCC Class B certification.

The zero-wait-state performance of the Acer 1100 puts it ahead of most other 80386 machines, positioning it between the PC's Limited 386-16 and Compaq Deskpro 386. However, I/O performance fits right in the pack because its expansion bus operates at the most typical 8 MHz.

Overall, the Acer 1100 is a solid, attractive, and well-built computer that's generally more than twice as fast as an AT.

ADVANCED LOGIC RESEARCH INC.

ALR 386/2

While most manufacturers are still putting the finishing touches on their first 80386-based PCs, Advanced Logic Research has rolled out its second-generation machine, the ALR 386/2. The company claims to be one of the first producers of personal computers based on the 32-bit chip, and the 386/2 shows they've learned how to make a top-quality product.

Although the 386/2 received for evalua-



► The floor-standing ALR 386/2 is Advanced Logic Research's second-generation 386 machine. It contains a system board designed and manufactured by ALR and accepts ALR's proprietary expansion cards for adding additional memory beyond the 1 megabyte of on-board RAM that comes with the base model.



FACT FILE

ALR 386/2

Advanced Logic Research Inc.

10 Chrysler

Irvine, CA 92718

(714) 581-6770

List Price: Model 10, with 1 Mbyte RAM,

1.2-Mbyte floppy disk drive, \$1,990; Model

40, with 40-Mbyte hard disk drive, \$3,990;

Model 80, with 70-Mbyte hard disk drive,

\$4,690; Model 130, with 130-Mbyte hard

disk drive, \$7,299.

In Short: The 386/2 has few faults, and its competitive pricing will make it a popular choice for budget-minded buyers who want quality.

CIRCLE 106 ON READER SERVICE CARD

tion was a floor-standing model, the system conforms to the basic AT design scheme—one full-height internal hard disk bay and a stack of three half-height bays on top (or to the right, depending on how you look at things), all for standard 5¼-inch form factor devices. In the ALR scheme, however, all three drives in the triple bay have front-panel access.

One high-density, 1.2-megabyte, 5¼-inch floppy disk drive is supplied as standard equipment.

The floor-standing system unit case is all metal construction except for its attractive beige plastic front panel that's highlighted by a wide swath of charcoal-gray

ribbing that hides its ventilation slots.

As a desktop machine, it's quite attractive. The conversion to floor-mounting is somewhat imperfect, however, with the logo and legend reading sideways and connectors running the full height of the rear panel. Gaining access to expansion slots proved to be somewhat troublesome, and the package earned only a Class A (business-use only) rating from the FCC.

At the rear are connectors for incoming AC and a switched outlet for powering a display, both mounted on the 200-watt Astec power supply, switch selectable for 120 or 240 volts. Its big, red paddle on/off switch peers from the rear of the top-cum-

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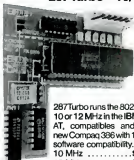
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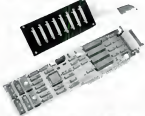
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right side of the chassis. At center rear are five blanked-off holes for installing communications connectors (three for DB-25 and two for DB-9 connectors) and the keyboard jack.

The ALR-designed-and-manufactured system board occupies most of the bottom of the chassis. A large block of the board space is occupied by four banks of sockets for 18 256-kilobit, 80-nanosecond DRAM (dynamic random access memory) chips each, a total of 72. The base model of the 386/2 comes with these sockets half-filled, yielding 1 megabyte of on-board RAM using a 32-bit bus, with a capacity of 2 megabytes.

Further memory can be added using two proprietary 32-bit expansion slots. Proprietary ALR cards add up to 2 megabytes each, along with additional communications ports. These 32-bit slots use connectors identical to standard AT 16-bit slots but are not compatible. Only a legend silk-screened on the system board prevents the insertion of an incompatible board.

In addition, two 8-bit and four 16-bit expansion slots are located on the ALR system board. A combined floppy disk controller and communications adapter occupies one 8-bit slot in the base model. The card provides a serial port which uses a male DB-9 connector and a parallel port with a female DB-25 connector.

ADDITIONAL PURCHASE Adding a hard disk thus requires the additional purchase of a controller card. ALR supplies a Western Digital WD1006, which can operate two ST-506-interface hard disks and supports one-to-one interleaving and full-track buffering to enhance disk performance.

Complementing this controller in the evaluation machine was a half-height Microscience 40-megabyte hard disk, which delivered an average access time of 32 milliseconds. ALR includes Storage Dimension's *SpeedStor* diagnostic and installation software with machines equipped at the factory with hard disks.

The review machine was also equipped with ALR's own EGA adapter. To improve its performance and the response of the system, the 386/2 automatically loads the BIOS firmware from 16-bit ROM into faster 32-bit RAM memory (which speeds

ORIGINS OF A SPECIES

As you read through the reviews and fact files of this first collection of 80386-based personal computers, you may notice an interesting geographical aberration: not one of the machines hails from Japan.

Taiwan is well represented, as is Texas, U.S.A., but because the ability of manufacturers to get 386s on the market depends so heavily on their access to Intel's 80386 microprocessor, the Americans have taken the lead.

Nevertheless, there are plenty of 386s on the Far Eastern horizon, and some are shipping already, most notably the NEC PowerMate. Other manufacturers (Japanese and otherwise) with 386s in various stages of development, production, and marketing include:

American Computer & Peripheral Inc.
ALPS Electric USA
AMQ Computer
American Research Corp.
Bi-Tech Enterprises
Cheetah International
Computer Dynamics Inc.
Eltech Research
Future International
Generic Technologies
Gold Star

Gulfstream Micro Systems Inc.
Hyosung Computer
Information & Technology Services
ITT
Micro I
Mini-Micro Business Systems
Mitac International
Mitsubishi Electronics America
NCR Corp.
Olivetti USA
Osicom Technologies
PC Designs Inc.
Power Systems
Texas Instruments
Wang Laboratories Inc.
Wyse Technology
Zenith Data Systems
Zykor Technology

If an 80386-based PC that you've heard about or have read about in *PC Magazine's* First Looks section wasn't reviewed in this article, the machine was not available at the time of our evaluations. We will continue to review computers in this ever-expanding group as they hit the market.

—Donald P. Willmott

Donald P. Willmott is an assistant editor on the staff of PC Magazine.

the execution of this code). This feature can be temporarily or permanently defeated should it cause compatibility problems. The BIOS itself bears a Phoenix Technologies copyright.

The 80386 microprocessor of the 386/2 operates at either 16 or 10 MHz, keyboard selectable. Expansion slots operate at 8 MHz, and one wait state is inserted during memory accesses. A socket is provided for adding an 80287-10 or 80387 numeric coprocessor, which runs at 10 MHz regardless of CPU speed.

ALR ships a BTC (Behavior Tech Computer) keyboard that uses a layout similar to that of the 101-key IBM Advanced Keyboard but just different enough to be confusing. A macro key has been added on the far left of the Spacebar row and the Backslash has been moved to the

far right of the same row to make room for an oversize (or correctly sized, depending on your outlook and finger dimensions) Enter key.

Typing on this keyboard was unsatisfying, requiring greater-than-normal effort and yielding unusual tactile feedback (required force abruptly increases when contact is made). A slight amount of audible feedback is generated by the system unit speaker.

The system is accompanied by a thin, but clearly written, setup and installation manual that does a good job of documenting the adjustment you have to make to the single-system-board DIP switch bank. A disk-based setup program (which includes support for a generous 41 different hard disk configurations) configures CMOS memory and sets the battery-backed-up

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- NORTON SI RATING 10.3
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CIRCLE 386 ON READER SERVICE CARD

■ 386 COMPUTERS

clock that is built into the system board.

Although neither DOS nor BASIC is supplied with the 386/2—it runs PC-DOS 3.3 just fine—ALR does provide a copy of the *DESQview* multitasking environment, which includes a special EMS driver that takes advantage of some of the special features of the 80386 chip.

The ALR 386/2 is a solid, workable computer with few faults (the keyboard, the 32-bit slots) and the advantage of 80386 speed and features.

CHICAGO COMPUTER CONNECTION

CCC-386c

Packing 80386 power into an ordinary AT-style chassis might evoke images of a wolf in sheep's clothing, but the vestments of this machine from the Chicago Computer Connection might better be classed as cheap rather than sheep. Just as that word of economy conjures up various connotations, so does the CCC-386c.

Certainly it's hard to fault a machine with a full 32-bit microprocessor running at 16 MHz, at least until you realize that its workmanship is mediocre, its documentation is deficient, and its features bear little resemblance to its maker's claims.

Basically, the CCC-386c is build-it-yourself technology from someone else's hands. The system is built around a stock AT chassis, completely anonymous in that



► The CCC-386c is a bargain-basement product constructed around a stock AT chassis. The system board is a Taiwanese import with room for an 80287 numeric coprocessor but no installed memory. System RAM is assigned to an expansion board that fits into the system's single proprietary 32-bit socket.



FACT FILE

CCC-386c

Chicago Computer Connection
5239 N. Harlem Ave.
Chicago, IL 60656
(800) 422-2666
(312) 774-0091 (in Ill.)

List Price: With 1 Mbyte RAM, 1.2-Mbyte floppy disk drive, monochrome graphics card with parallel ports, \$2,995; 30-Mbyte hard disk drive, \$649; 40-Mbyte hard disk drive, \$699; 80-Mbyte hard disk drive, \$1,099; monochrome monitor and card, \$179; EGA monitor and card, \$399; MS-DOS 3.2, \$89.
In Short: The CCC-386c will outperform its mail-order, AT-compatible competition, but its quality does not match up to its 386 rivals.

CIRCLE 107 ON READER SERVICE CARD

it lacks any sort of logo on its front panel.

The chassis conforms perfectly to the AT mold in size, shape, and color, with an internal 5¼-inch full-height drive bay for a hard disk and three half-height bays on its right, only two of which can be accessed through the front panel.

The obligatory big red power paddle adorns the right rear, and both power-in and switched-power-out jacks augment the rear panel, part of the 200-watt power supply. In the center of the rear panel you'll find five blanked-off holes for communications connectors, two for DB-9s and three for DB-25s. Under them is the key-

board connector, and the retaining brackets for eight slots finish off the details of the rear.

Glued (literally) to the rear panel is a battery holder with four AA-cells for keeping the CMOS configuration memory and clock running. Although the Chicago Computer Connection says the machine is FCC Class A approved (business-use only), there's no trace of a certification sticker or waiver.

Inside the chassis you'll find an 80386-based system board bearing the imprint of Four Star. It's likely that this board has seen more of the world than you have, hav-

ing found its way to America, Chicago, and your doorstep after having left home in Taiwan.

The sparsely populated board provides space for an 80287 numeric coprocessor socket, a collection of ROMs bearing a BIOS with a Phoenix Technologies copyright, a pair of empty ROM sockets, and no memory. Jumpers allow operation of the coprocessor at 4, 8, or 10 MHz. A program accompanying the system allows selection of one of five CPU operating speeds: 16, 8, 6, 4, or 2 MHz, all with zero wait states.

■ The CCC-386c is an entirely workable computer that makes its mail-order AT-clone competition look like snails caught in molasses.

System RAM, in the form of 256-kilobit, 100-nanosecond dynamic memory chips, is all reserved to an expansion board that fits into the system's single proprietary 32-bit socket. Exactly 768K of DRAM—not the 1 megabyte claimed in promotional materials—is soldered to this board (in three parity-checked banks of nine chips each) in standard configuration. An additional 36 sockets allow a full megabyte of expansion. Only 640K of the native endowment of the CCC-386c is usable, strictly as DOS memory.

ENDOWMENT LACKING Seven other expansion slots are provided on the system board. Although promotional materials from the Chicago Computer Connection indicate you get three 32-bit, four 16-bit, and one 8-bit slot, a visual inspection revealed that actual endowment to be two 8-bit and five 16-bit slots, in addition to the single proprietary 32-bit connector.

Of these, one 16-bit slot is devoted to a Western Digital WD1003 combined floppy-and-hard-disk controller, and the two

8-biters go to an optional (\$99) serial card and a monochrome/graphics display adapter that has a built-in parallel port. The serial port uses an XT-style male DB-25 connector, while the parallel port uses a female DB-25.

In the mass-storage department, standard equipment includes a single 5¼-inch, high-density (1.2-megabyte) floppy disk drive. The evaluation system was also equipped with an optional (\$699) half-height Seagate ST-251 hard disk in its internal drive bay. Through its ST-506 interface, this drive delivered an average access time of 43 milliseconds—not quite in the AT performance range, let alone 80386. Ontrack Computer Systems' *Disk Manager* was supplied for dividing the disk into DOS-size volumes.

The keyboard is a Hi-Tek product based on the original AT design with 84 keys, three indicator LEDs for its locking shift keys, and a completely bland touch—the keyboard itself yields neither tactile nor audible feedback, although the slightest click can be heard from the system unit speaker. As a \$59 option the Chicago Computer Connection supplies a 101-key keyboard patterned after the IBM Advanced Keyboard model.

The Hi-Tek keyboard also features the most uncomfortable Spacebar I've encountered, apparently designed to gouge a groove in your thumb. You can type on it, but it's nothing to win favor from those chained to its keys.

CCC also supplied a Samsung amber monitor to match the display card (\$179 for the pair) and it worked well enough. The compact set has a screen roughly the size of the IBM Monochrome Display. Two user controls are featured up front—power on and off and contrast. Brightness, vertical size, and vertical hold bring up the rear. Despite the switchable outlet on the back of the CCC-386c system unit, the Samsung cord is designed for plugging directly into the wall, so the system unit power switch cannot control it.

Documentation is scant at best, merely a few sheets showing jumper configurations with little accompanying explanation. A software-based setup program for changing CMOS configuration and low-level formatting of the hard disk is also supplied.

In truth, the CCC-386c is an entirely workable computer (if your thumb holds out) that makes its mail-order AT-clone competition look like snails caught in a pool of molasses. Compared to the cream-of-the-crop company here, however, it's a poor cousin. If your budget is tight, you might be pleased with this bargain (base price: \$2,995). If not, there are better choices to be made.

COMPAQ COMPUTER CORP. Compaq Deskpro 386

To date Compaq Computer Corp. has sold more 80386-based computers than any other company—and with good reason. The Deskpro 386 was among the first (if not the first) of this genre actually to move off the loading dock.

The Deskpro 386 is heir to the line bearing its first name, fitting the familiar case used by the rest of the Deskpro machines, first equipped with the 8086 microprocessor. Roughly the same size and color as an IBM AT, the case stands tall enough to allow AT-size expansion cards to slip in, yet it looks smaller because it allows two side-

EDITOR'S CHOICE FACT FILE

Compaq Deskpro 386
Compaq Computer Corp.
20555 FM 149
Houston, TX 77070
(800) 231-0900

List Price: Model 40, with 1 Mbyte RAM, 1.2-Mbyte floppy disk drive, parallel and serial ports, 101-key keyboard, 40-Mbyte hard disk drive, \$6,499; Model 130 with 130-Mbyte hard disk drive, \$8,799. EGA monitor, \$799; EGA card, \$599; 1-Mbyte RAM upgrade, \$549; 4-Mbyte RAM upgrade, \$2,699; 1- to 2-Mbyte 32-bit memory expansion board (with 1 Mbyte RAM), \$849; 4- to 8-Mbyte memory expansion board (with 1 Mbyte RAM), \$2,999; 8-MHz 80287 math coprocessor, \$349; 40-Mbyte DC-2000 tape backup, \$799; second 40-Mbyte hard disk drive, \$2,199; 360K disk drive, \$225; 1.2-Mbyte hard disk drive, \$275; amber monitor, \$225; Compaq monochrome display adapter, \$199; DOS 3.1, \$85.

In Short: The Deskpro 386's high-quality engineering and rock-solid performance make it a winner. In this case, the first remains one of the best.

CIRCLE 88 ON READER SERVICE CARD

■ 386 COMPUTERS

by-side full-height drive bays to peer from the front panel instead of stacking three on the right.

The rear of the system supplies the necessary power connectors—electric-in to run the system and electric-out to light the display. The keyboard connector, however, calls the front panel home. Compaq has evidently discovered that most people work with their keyboards in front rather than in back of their computers.

The layout inside the chassis essentially conforms to the PC standard but the system board that underlies it all does not. Compaq's engineering wunderkinder have created the smoothest-operating, most-satisfying—though not the fastest—machine currently on the market.

The Deskpro's 80386 microprocessor purrs along at its full rated 16 MHz, using a memory arrangement that yields up about 0.8 wait states (Compaq's figure) in memory accesses. To allow compatibility with obstinate copy-protection schemes, a defeatable feature of the Deskpro 386 automatically slows the microprocessor to 8 MHz when a floppy disk is accessed.

While early models of the Deskpro offered the option of an 80287 numeric coprocessor (operating at either 4 or 8 MHz), all machines built since May are equipped to handle an 80387 coprocessor.

An unusual memory arrangement is the key to the strange wait-state figure Compaq attaches to the Deskpro. The base memory of the Deskpro 386 comprises four banks of nine 256-kilobit static-column dynamic RAM chips, totaling 1 megabyte, all mounted on a separate "system memory board."

The static-column dynamic RAM of the Deskpro gives the machine extremely fast access to memory within a 2K memory page in that accessing a subsequent word of memory within one page requires no CPU wait states. Fetching from outside the current page takes somewhat longer, however, requiring two wait states.

According to Compaq, with typical applications zero-wait-state operation occurs about 60 percent of the time, effectively yielding the equivalent of 0.8 wait states on general processing.

Sockets are already installed on the system memory board for adding a second megabyte, and daughtercards are available



► Special engineering touches place the Compaq Deskpro 386 among the leading 386 performers. For instance, Compaq allows mapping 128K RAM to duplicate system ROM, boosting the performance of BIOS routines by about a factor of four. Extremely fast static-column dynamic RAM makes up the machine's base memory.



that add sockets for another 1 or 2 megabytes in 256-kilobit chips or up to 8 megabytes in megabit memory chips, all static-column dynamic RAM.

The system memory board attaches to the Deskpro 386 system board using a special proprietary 32-bit memory-only bus. In addition, memory can be expanded to a total of 14 megabytes using the 16-bit bus width of the Deskpro's AT-style expansion slots.

USEFUL BYTES Compaq makes the bytes beyond DOS's 640K addressing limit useful by providing an EMS driver that

turns the extended memory area into expanded memory. Further, Compaq allows mapping 128K of RAM to duplicate system ROM, boosting the performance of BIOS routines by about a factor of four.

Seven expansion slots (in addition to its dedicated-to-memory 32-bit slot) are built into the Deskpro 386. Four are AT-style 16-bit slots and three are 8-bit PC/XT-style slots. One of the 8-bit slots is 7 inches long; the rest are full length. All are full AT height. The expansion bus operates at 8 MHz and may impose wait states.

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According to *PC Week*, "The Inboard 386 proved perfectly compatible with a standard IBM PC AT and every software product we tested." It's compatible with advanced software, too, including the new 386 control software for

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terface hard disk, one 16-bit slot is reserved for a combined hard-and-floppy-disk controller. The Model 130, equipped with a 130-megabyte ESDI-interface disk, fills two 16-bit slots with separate hard- and floppy-disk controllers. The standard-equipment display adapter consumes one 8-bit slot.

The hard disk of the evaluation unit, a Deskpro Model 40, was a half-height Tandon unit that demonstrated a fast, 30-millisecond average access time and used a two-to-one interleave factor.

Standard mass storage in the Deskpro 386 includes a 5¼-inch, high-density (1.2-megabyte) floppy disk drive. The remaining vacant half or whole slot can be filled with additional high-density or ordinary (double-sided, double-density) floppies to total two floppy disks, a miniaturized DC-2000 tape backup system, and/or (in the case of the 40-megabyte system) a second hard disk with the same capacity as the first.

The Deskpro systems are also equipped with one serial and one parallel port, the circuitry of which is built into the disk controller card. Both ports follow AT practice, with a male DB-9 connector for the serial port and a female DB-25 for the parallel.

Also standard equipment is an AT-style battery backed-up clock and software setup scheme to match it to its memory and major internal peripherals. Contrary to the current trend, however, the Deskpro 386 also uses several jumpers and a DIP switch bank to allow extreme flexibility in allocating system memory and other operating parameters.

Compaq offers two display systems with the Deskpro 386—either an amber or green Compaq Dual-Mode Monitor and Compaq Video Display Controller Board for graphics-compatible monochrome displays, or a Compaq Color Monitor and Compaq Enhanced Color Graphics Board for both CGA- and EGA-compatible color graphics. The EGA card also has the capability to use 32-bit memory, making some video operations twice as fast.

With the Deskpro 386, you also get your choice of keyboard styles—either 84 keys in the original (large Enter key) AT layout or a close copy of IBM's new 101-key Enhanced (12 top-row function keys

and dedicated cursor pad) Keyboard model. The feel on either keyboard is very good, although stiff, and an electronic keyclick is provided.

Compaq has positioned itself at the high end of the 80386 market, if by its \$6,499 price alone. The quality of this machine and even its subjective feel live up to that placement.

COMPUTER CLASSIFIEDS INC.

CCI ST/386

Knowing that no one wants to be stuck with last year's technology, Computer Classifieds Inc. (CCI) hit upon a classic computer design that eliminates obsolescence. Instead of installing the microprocessor on the system board, the company put the all-important chip on its own expansion card. When the moon changes phases and today's state of the art becomes passé, you can pop out the unfavored microprocessor and drop in the latest darling.

Thus the chassis of the ST/386 harks back to near prehistoric times when the 80286 chip won the roses for best desktop performance. It looks like an AT clone because that's what it was. Called the ST/286, a name still emblazoned on the

front panel of the evaluation unit, the first incarnation of this PC ran its 80286 at 12 MHz.

In the months since it was last reviewed in the pages of this magazine, CCI moved to a new 80386 card, further boosting the power of the system. Strangely, the new chip runs at the odd speed of 14.2 MHz (not the 16 at which it is rated) with one wait state, as does the ST/386 expansion bus, or so claims CCI. Overall performance works out at about 80 percent better than IBM's 8-MHz PC AT and about 10 percent less than Compaq's Deskpro 386.

The styling of the ST/386 looks entirely ordinary. The upper left of the front panel holds the requisite miniature control panel, complete with system keylock (which prevents under-the-cover access), power on, drive activity and "turbo" indicators, and a square red system-reset button. The turbo light hints that this is a two-speed system, switchable from the keyboard at any time, with its slow speed knocking clock performance in half, down to the AT-compatibility level.

Drive bays match the IBM allotment: a single 5¼-inch full-height internal bay for hard disks and three half-height bays on the right—two with front-panel access, for floppies or other storage devices.

One 5¼-inch, high-density (1.2-megabyte) floppy disk is standard equipment. The evaluation machine was also equipped with an optional Micropolis 40-megabyte hard disk that achieved commendable performance—an average access time of about 29 milliseconds—through its ST506 interface.

The power supply hangs its power-controlling red tongue out the rear of the right side of the chassis and provided the standard line-voltage-in and switched-power-to-the-display jacks on the rear panel. Apparently a 117-volts-only model (no adjustment switch is visible), the power supply is physically XT-size and hides its cooling fan inside the chassis. The power supply provides 200 watts.

COMPACT BOARD The remarkable part of the system is its compact, XT-size system board. It's sparsely populated, relying principally on the Chips and Technologies VLSI set to keep the component count low. CCI equips the ST/386 with a

PC MAGAZINE FACT FILE

CCI ST/386

Computer Classifieds Inc.

17830 State Rd. 9

Miami, FL 33162

(305) 651-5853

List Price: With 640K RAM, 1.2-Mbyte floppy disk drive, enhanced AT-style keyboard, Hercules-compatible monochrome graphics/printer adapter, high-resolution monochrome monitor, 40-Mbyte, 20-millisecond hard disk drive, \$3,195; Model 70, with 70-Mbyte, 28-millisecond hard disk drive, \$3,395; Model 80, with 80-Mbyte hard disk, \$3,595; Model 40 with 2.6 Mbytes of 32-bit RAM, \$3,695; Model 70 with 2.6 Mbytes of 32-bit RAM, \$3,895; Model 80 with 2.6 Mbytes of 32-bit RAM, \$4,095; EGA option (adapter and monitor), \$500.

In Short: The ST/386 has its 80386 chip on an expansion card, so CCI 286 owners can upgrade (\$800). It's a clever marketing idea for those who already own the box.

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► It's no surprise that the CCI ST/386 has the look of an ordinary AT compatible. It began life as the ST/286 with its CPU on an expansion card rather than on the motherboard. Reincarnation as a 386 machine entailed the simple expedient of pulling the 80286 chip and upgrading the microprocessor on the card to the 80386.



Phoenix Technologies BIOS.

The 80386 microprocessor itself resides on an 8-inch expansion card along with PLA (programmable logic array) chips and a socket for an 80287 numeric coprocessor. Through hardware, the coprocessor can be set up to run at either microprocessor speed or two-thirds microprocessor speed. Adding an additional oscillator allows it to function at "6, 8, or 10 MHz or other desired speed," according to the documentation.

Memory is relegated to another daughtercard using a proprietary 32-bit bus. The evaluation system was filled with 3 mega-

bytes, implemented with a full dozen soldered-in memory modules, each with eight 100-nanosecond, 256-kilobit DRAM chips. Of this, 2 megabytes were assigned as extended memory, 640K as DOS memory, and 128K of the remainder for "phantom ROM." The system automatically copies its BIOS from 16-bit ROM to this 32-bit DRAM to speed execution of its routines (and system performance).

Six other expansion slots are provided, three using the 8-bit XT bus, three with the 16-bit AT bus. All of these slots are full-length and AT height.

Standard equipment fills one of the 8-bit slots with a communications adapter that yields two serial and one parallel port. COM1 gets an AT-style 9-pin male connector, COM2 an XT-style 25-pin male connector. The parallel port uses a standard female DB-25.

■ CCI equips the ST/386 with a Phoenix Technologies BIOS.

One 16-bit slot is filled with a Western Digital WD1003 combined floppy-and-hard-disk controller. In the evaluation system, a second 8-bit slot hosted an optional Quadram EGA card.

Originally, CCI supplied the ST/386 with a 103-key BTC (Behavior Tech Computer) keyboard, but during our testing they changed suppliers, shipping us a replacement product bearing the name Magitronic.

Although the new choice conformed to the standard 101-key layout of the IBM Advanced Keyboard, its touch wasn't in the same league. The keyboard gave a linear feel with neither true tactile nor audible feedback. It proved typeable, more so than the first keyboard, but it rates as far from exemplary.

The system setup program is contained in ROM and can be accessed either by running a utility or by pressing F2 at an appointed time during boot-up. It supports nearly 40 different hard disks. A 6.8-volt Tadiran lithium battery attached with Velcro to the top of the power supply keeps the CMOS configuration memory and built-in system clock alive when the electricity is switched off.

Interestingly, the rear panel bears a sticker claiming FCC Class A approval and another inside the system claims Class B. Neither, predictably, boasts a certification number.

If you've got an old 80286 model, the CCI upgrade, priced at \$800, may be worth considering, but the performance tests show that most other 80386s leave this one behind.

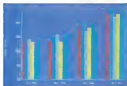


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CIRCLE 385 ON READER SERVICE CARD

■ 386 COMPUTERS

CORVUS SYSTEMS INC. Corvus 386

A teapot among towers, the Corvus 386 is short and squat (16 by 16 by 11 inches), a low-rise machine that might double as a footstool were it only equipped with a padded top. The handle that's actually hidden there is an invitation to a hernia, as the hefty hardware weighs in at 52 pounds.

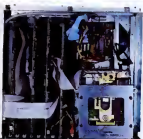
Although the floor-hugging design might be more fitting for the network server that would be expected from Corvus, a manufacturer highly regarded in that field, the 386 functions admirably as a stand-alone, single-user computer. Its 80386 brain makes it formidable competition for all but the mightiest contenders, and its minicomputer-like construction assures that it will be around long after meeker systems have gone the way of all things.

The unusual packaging allows for a uniquely large number of mass-storage expansion options. A total of four 5¼-inch, half-height drive bays have front-panel access, and another full-height bay is tucked safely inside the cabinet underneath the right pair of accessible bays. All bays are vertically oriented; drives are installed in them without rails, using only their natural, tapped, side-mounting holes.

Beneath the left-hand bays is a small control panel that includes a system key-



► The Corvus 386 is solid and capacious: four vertically oriented 5¼-inch, half-height drive bays have front-panel access and another full-height bay is tucked safely underneath the right pair of accessible bays. Expansion slots total eight, all full length and full AT height.



FACT FILE

Corvus 386

Corvus Systems Inc.
160 Great Oaks Blvd.
San Jose, CA 95119
(408) 281-4100
List Price: With 512K RAM, 1.2-Mbyte floppy disk drive, clock/calendar, serial, parallel ports, eight expansion slots, \$6,595; monochrome graphics monitor and card (amber or green), \$395; color graphics system, \$665; EGA monitor and card, \$1,495; 2-Mbyte memory expansion, \$1,895; 360K floppy disk drive, \$197; 20-Mbyte hard disk drive, \$725; 40-Mbyte hard disk drive, \$1,475.

In Short: The virtues of the Corvus 386 are its rugged construction and its incredible capacity for mass-storage devices, making it a strong contender for use as a file server.

CIRCLE 684 ON READER SERVICE CARD

lock (which does not prevent access inside the case), a drive activity indicator, and a power indicator.

The rear of the machine was arranged with atypical forethought about cabling. Nearly all wires attach below the centerline of the chassis, including the keyboard, power-in and switched-power-out (to the display) connectors, and the optional retaining brackets of the expansion slots. The rocker switch, which controls system power, is located here, too.

Somewhat higher on the chassis are the connectors for the system's built-in ports—a male DB-25 for a serial port and a female DB-25 for parallel devices—at the

bottom of a stack of six more blanked cut-outs for mounting additional connectors of the same size without using expansion card retaining brackets.

The cover of the left side of the chassis comes off to give access to the system board, which runs down the vertical center of the 386, and expansion slots. The right-side cover hides only the other two half-height bays, the internal drive bay, and the unrated full-chassis-length power supply, selectable between 117- and 240-volt operation by a rear panel switch.

Once you are inside the Corvus system unit, its originality fades. The system board is an off-the-line Intel OEM prod-

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PROGRAMMING:

One of the largest software developers in the U.S. uses Bernoulli Boxes to manage enormous amounts of software source code. Programmers record all the source code for an application on one cartridge, make backup cartridges for protection, and work directly from a "working" cartridge. This allows them to modify code or develop revisions on multiple cartridges, without fear of damaging the original source code, which is safely

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GRAPHICS:

An architect in Chicago uses over 40 Bernoulli Cartridges a year archiving lengthy architectural designs generated on a CAD system. Using a Bernoulli Box gives

him unlimited storage capacity, plus the portability to take cartridges with him when he meets with clients and contractors (many of whom also use a Bernoulli Box). This fast growth is a powerful benefit of Bernoulli Technology,™ whether for CAD, graphics or desktop publishing.

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ENTIAL

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A medical insurance carrier with offices worldwide must keep track of an enormous number of records for millions of claimants. The company uses Bernoulli Boxes which allow easy access to information, infinite storage capacity and a simple system for database management of archival data. Individual offices use cartridges to update critical information on a timely basis and send updates to the company's central database.

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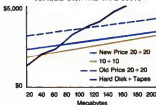
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ATTENTION TO DETAILS



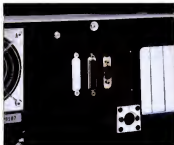
The Compaq Deskpro 386 has a design feature that should be emulated by every PC manufacturer: the keyboard connects to the front of the chassis, not around back. It's a small detail, but one that shows how creatively the machine is designed.



Insuring its machine against obsolescence, CCI puts the 80386 chip in its ST386 on an expansion card as opposed to wiring it into the motherboard. This feature makes CCI's 286-based machines upgradable.



The Corvus 386 has an unusually large number of available drive bays, including four half-height bays accessible from the outside and one internal full-height bay.



In order to meet FCC certification requirements, 386-based computer manufacturers have to make their machines as radiation leak-proof as possible. In the case of the Kaypro 386, the back panel has a wide variety of screws and plugs that fill every gap.



The portable Noble 386 from PC Discount has a pair of stand-up feet on its base to allow for easier viewing of the CRT display, but it also has a second, mysterious pair of feet on its top side.

uct, with all its features and shortcomings. The processor is, of course, an 80386 operating at 16 MHz with one wait state on memory accesses. Using the keyboard, it can be slowed to 8 MHz for compatibility purposes. A socket is provided for an 80387 numeric coprocessor.

Inside the rear panel, held by Velcro, is a lithium battery for keeping the CMOS configuration memory and the built-in clock fresh.

Corvus has used the Intel board intact, adding its own BIOS and snaking an extension cable on the keyboard jack to put the external connector at the bottom of the chassis. Even so, and despite the all-metal chassis (only the front panel is plastic), the system earns only an FCC Class A rating.

System board RAM totals 512K, all dynamic and assigned to DOS through a 32-bit data path. In the evaluation machine, Corvus loaded one 32-bit expansion slot

with a memory board weighted down with 2 megabytes in eight banks of 100-nano-second, 256-kilobit chips that serve as extended memory.

Expansion slots total eight—two with the Intel proprietary 32-bit bus, four with an AT-compatible 16-bit bus, and two with an XT-compatible 8-bit bus. All are full length and full AT height. In addition to the memory board, slots in the evaluation machine were filled with a Western



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CIRCLE 733 ON READER SERVICE CARD

PC Magazine
August 1987

Editor's Choice

■ 386 COMPUTERS

Digital WD1003 combined floppy-and-hard-disk controller, a controller for a DC600-style tape cartridge backup system, and a monochrome/graphics card. Only the first of these boards required a 16-bit slot.

A FLOTILLA OF DRIVES Corvus equipped the evaluation machine with a flotilla of drives: the standard equipment high-density (1.2-megabyte) 5¼-inch floppy disk; an optional double-sided, double-density (360K) floppy disk; an optional Wangtek tape drive; and a Control Data (CDC) full-height, 70-megabyte hard disk. Even so, one half-height drive bay remained vacant.

The 29-millisecond average access time of the CDC drive matched the performance of the system perfectly and made programs snap onto the screen. The tape drive was accompanied by Sytron Corp.'s *Pulse* software, which uses a data format interchangeable with that of IBM's external PC tape cartridge machines.

The Corvus keyboard is manufactured by Maxi-Switch Co. and follows the original AT 84-key layout. Its rubber-dome technology gives good tactile feedback with a light touch but without audible reinforcement.

Overall, the Corvus 386 gives an impression of strength—from its weight, from its stocky design, from the roar of its uncommonly noisy power supply fan. Despite its garden-variety system board, this machine is an impressive, well-built, and powerful computer worthy of the toughest assignments.

IBM CORP.

IBM Personal System/2 Model 80

Strange as it may seem, the least PC-compatible of these 80386 machines is made by IBM. In fact, had any other company introduced the Personal System/2 Model 80, it would be praised as a happy aberration—an extremely clever, innovative machine that makes a genuine advance in technology—but one destined ultimately to fail because of its lack of the utmost in PC compatibility.

Because it's an IBM product, however, many industry pundits see the Model 80 as



► *Not particularly PC compatible but a beautifully constructed and clever, innovative machine all the same, the IBM Personal System/2 Model 80 is the perfect desk-side companion—quiet and fast. Once software permits its Micro Channel architecture to show what it can do, the competition will be hard-pressed to catch up.*



something created only to increase Big Blue's bottom line by forcing a new standard down everyone's throat. Indeed, at least two of the Model 80's innovations—3½-inch drives and VGA graphics—are likely to catch on as new standards. But play with or work on the Model 80 for a few minutes and you'll appreciate that it's more than a renegade machine—it's a genuine advance and probably the best 80386-based PC compatible currently available.

The Model 80 is a modern monolith in the style of Digital Equipment Co.'s towering minicomputers, and at about 4 MIPs, it rivals them in power. Standing 24

inches high, 7 inches wide, and 19 inches deep (ignoring its foot-wide flipper-feet), the Model 80 is molded from reinforced plastic, finished in pale beige on the outside and interference-preventing conductive paint on the inside. This shielding is good enough to earn the Model 80 an FCC Class B certification.

It's a perfect desk-side companion. More than just attractive, the Model 80 and its PS/2 kin are the first PCs I would not mind sharing my office with—finally a manufacturer has built a quiet computer. Compared with the Model 80, the other 80386-based PCs sound like vacuum cleaners raging on your desk.

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CHOICE**

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 List Price: \$6,995 (includes 1 Mbyte RAM;
 1.44-Mbyte floppy disk drive; 44-Mbyte
 hard disk drive; clock/calendar; serial, paral-
 lel, mouse, and video ports; 11 slots; 225
 watts power; IBM Enhanced keyboard). Op-
 tions include 70-Mbyte hard disk drive,
 \$2,395; 12-inch VGA monitor, \$685;
 mouse, \$95; DOS 3.3, \$120.
In Short: Probably the best personal com-
 puter available, the PS/2 Model 80 is beau-
 tifully built, incorporates true innovations, and
 provides fast, reliable performance.
CIRCLE 642 ON READER SERVICE CARD

As with the other freestanding PS/2, the Model 60, the Model 80 is laid out with its expansion slots at the bottom, so delicate cables stay farthest out of harm's way. Connectors, however, run all the way up the rear of the chassis. Above the slots are male DB-25 serial and female DB-25 parallel connectors and two of the input device connectors (mouse and keyboard). Above them all is the input power jack. No switched outlet is available to control the display, although the system unit power cable provides a spare outlet on the back of its plug should your office have a deficiency in wall outlets (as all computer-equipped offices inevitably do).

Although I'd rather see all the connectors clustered at the bottom of the chassis, physical reality may make such arrangements difficult (the Corvus 386 comes close to this ideal, however).

INSIDE THE 80 You get inside the Model 80 by removing the left side of the chassis, which is secured by two large capture-screws (a nickel or a penny fits the slots) and a vending-machine/pay-phone-style round keylock. This lock prevents only physical access—it doesn't lock the keyboard. Keyboard password protection and power-on system password protection are built into the Model 80 BIOS.

The Model 80's internal layout is nearly identical to the Model 60's; only the system board appears changed. At the top of the chassis, the big chrome box of the pow-

er supply, complete with a large, low-noise fan, runs the full depth of the machine. The power supply automatically adjusts itself to any standard power source in the world in two ranges, 100-125 and 200-240 volts. The power switch projects from the front of the box through the front panel.

Below this box and toward the front are a stack of slide-in slots for two 3½-inch mass storage devices. The top slot comes from the factory filled with a 1.44-megabyte floppy disk. Additional devices can be slid into place without even removing the front-panel bezel.

Further below is a mounting cage for two full-height, internal 5¼-inch devices, one bay of which can have front-panel access. IBM currently supplies either 40- or 70-megabyte disks in the rear of this cage, with a 130-megabyte unit planned for the future. Drives slide into place and are secured without tools, held in place instead by two hand-screw clamps. Optical drives can also be added either internally or externally.

The system board underlies the hard disk bay and continues down to the base of the chassis. As with other Personal System/2 models, the circuitry of this planar board includes a floppy disk drive controller, I/O, communication and printer ports, and the Video Graphics Array. The board is dotted with tiny flecks of surface mount devices and big splashes of IBM proprietary VLSI chips with only a handful of conventional lead-in-hole components. At bottom front is the big, beautiful (in a technical way) 80386 chip, with a socket for an 80387 nearby.

The planar board holds only video memory. System RAM is consigned to two special connectors tucked at the rear of the planar board between the power supply and hard disk bay. Each plug-in memory card holds 18 half-megabit memory modules in tall, half-inch-square metal cases. One board and one megabyte are standard in the 40-megabyte machine; two boards give the 70-megabyte Model 80 two full megabytes. Expansion slots are, of course, Micro Channel architecture—three using a 32-bit data bus, four 16-bit, and one 16-bit with the IBM video extension. Since IBM hasn't announced any intention to license the female part of the Micro Channel bus,

any boards you buy will have to have been adapted to run with this architecture. This shouldn't be a problem, but it does set up a second standard in board interfaces. In the standard factory-issue Model 80, the top-most 16-bit slot is taken up by the hard disk controller. In the 70-megabyte model evaluated here, the controller used an ESDI interface.

■ **The Model 80 must be the most responsive PC available—press Enter and your application snaps on the screen.**

The chassis cover includes a clear plastic plenum that routes airflow over the expansion area. Below the plenum and in front of the slot is a plug-in speaker-and-battery assembly. Like ATs and other PS/2s, the Model 80 includes a battery-backed-up clock and CMOS configuration memory. The Model 80 keyboard is the standard IBM Advanced design with 101 keys and IBM's wonderful, clicky feel that gives full-tactile and audible feedback. (Of course, not everyone is a devotee of this keyboard. Some say it doesn't feel as nice as the old 84-key model, and there are still people who hate functions arrayed across the top of the keyboard instead of down the left-hand side.)

The more you work with the optional VGA display, the more its wonders become apparent. For instance, not only does the VGA include more resolution (640 by 480 pixels tops) and colors (up to 256 in 320 by 200 mode), but it also has a narrow border around the active video area so that reverse video text doesn't inevitably run into the background. Because it uses analog signals, the VGA (and the Model 80) is not compatible with conventional PC color or monochrome displays.

FAST, FAST, FAST The Model 80 must be the most responsive personal computer available—press the Enter key and your

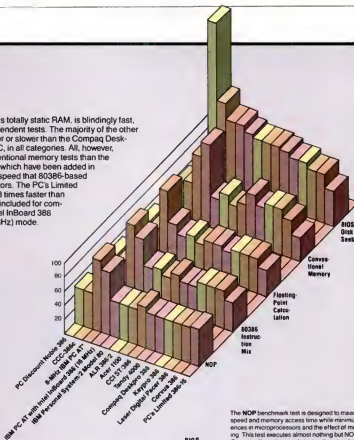


Benchmark Tests: 80386-Based PCs

The PC's Limited 386-16, with its totally static RAM, is blindingly fast, especially in the memory-dependent tests. The majority of the other machines test either slightly faster or slower than the Compaq Deskpro 386, the first 80386-based PC, in all categories. All, however, are faster in processor and conventional memory tests than the 8-MHz IBM PC AT, the results for which have been added in order to demonstrate the leap in speed that 80386-based PCs have made over their ancestors. The PC's Limited machine, for example, is almost 3 times faster than the AT in the memory tests. Also included for comparison are the results for the Intel InBoard 386 accelerator board in its fast (16 MHz) mode.

Relative Times

(Ratio 8-MHz IBM PC AT = 100)



Performance Times

(Times given in seconds except where noted)

	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	BIOS Disk Seek (milliseconds)
PC Discount Nobla 386	2.09	4.61	17.4	0.72	110.4
CCC-386c	2.09	4.01	15.5	0.77	45.2
8-MHz IBM PC AT*	4.17	8.96	35.6	1.32	37.2
IBM PC AT with Intel InBoard 386 (16 MHz)	3.68	7.64	20.1	1.60	36.8
IBM Personal System/2 Model 80	2.09	4.39	15.6	0.63	33.6
ALR 386/2	2.09	4.62	17.1	0.77	32.7
Acer 1100	2.09	4.01	14.9	0.61	32.3
CC1 ST/386	2.36	4.66	17.4	0.69	31.9
Tandy 4000	2.09	4.12	17.1	0.94	30.9
Compaq Deskpro 386	2.09	4.01	15.5	0.77	29.2
Keypro 386	2.15	4.72	17.3	0.85	28.8
Laser Digital Pacer 386	2.09	4.62	17.3	0.85	26.4
Corvus 386	2.09	4.61	17.3	0.71	26.1
PC's Limited 386-16	2.15	3.57	13.4	0.44	19.0

*The IBM PC AT was tested using the 80286 Instruction Mix test

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The 80386 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The Conventional Memory benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result is the average of the read and write times.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test routine includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

■ 386 COMPUTERS

application snaps on the screen. The reason is the combination of innovations in the PS/2 line. First, the VGA is really fast. Using the BIOS teletype function, the screen fills twice as fast as the Compaq Deskpro 386 EGA, for instance. The 33-millisecond average-access-time, 70-megabyte hard disk uses a 10-MHz data transfer rate, special IBM caching software, and an unusual control scheme (which makes the Model 80 think the drive has 64 heads) to speed performance.

Although the 16-MHz, one-wait-state speed of the 80386 microprocessor is only average among this high-speed competition, at twice as fast as an AT, the Micro Channel really makes a difference. In PC Labs memory benchmark tests, extended RAM reads and writes are six to eight times as fast as an AT and up to twice as fast as the Compaq Deskpro 386. The Model 80 definitely is not as PC compatible as the other machines reviewed here. PC and AT expansion cards won't fit its Micro Channel slots. Standard floppies won't fit its 3½-inch drives. And a surprising number of programs may not work.

Specifically, misbehaved programs that directly control hardware may flounder and fail. For instance, two communications programs that I used to move files into the Model 80—*The Knowledge Network* and *LapLink*—crashed at high data rates (beyond those officially supported by IBM), probably because of differences in the 16550 UART chip used in the Model 80 and the 16450 and 8450 used in previous PCs. In addition, programs that take direct hard disk control (such as *LapLink* and even Core's *DISK* test program) may crumble when they collide with the Model 80's ESDI interface.

These compatibility problems will likely disappear as software is revised, however, just as the minor incompatibilities of the AT vanished in less than a year. The power of the Model 80 won't be truly tapped until more software takes advantage of its super-high-speed extended memory and Micro Channel architecture. But the same software that lets the rest of these 80386-based PCs run 32-bit instructions—OS/2 for the 80386—will also let the Micro Channel take off. Once it does, the rest of the industry will be hard-pressed to catch it.

KAYPRO CORP.

Kaypro 386

On the front panel, the only indication that the Kaypro 386 is different from its 80286-based forebears is the square logo in the upper-left-hand corner. The face is the same, pale beige with an unmistakable greenish tinge and black drive bezels, different in color but matching IBM's AT styling except for the decided bend and stagger in the ventilation slots.

Space is allowed for five half-height drive bays, two with front-panel access. Even the small indicator panel, resplendent with power and drive activity LEDs and a system keylock, is borrowed from previous design efforts.

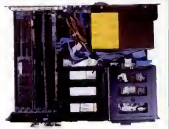
A look at the back reveals a subtle change. Where the 80286-based Kaypros had an excess of connector cutouts and a large hole for plugging in the keyboard connector, the back of the 386 has no aperture.

It's a simple story: every leak through which RFI (radio frequency interference, the stuff the FCC has conniptions about) might escape has been plugged. In the case of the Kaypro 386, the oakum used is a collection of unmatched screws and other hastily added hardware. It looks like the product of a garage workshop, although it is sturdy enough and the FCC Class B approval sticker attests to its effectiveness.

The dip in the mechanical quality level is also apparent in the expansion slots. The



► The chassis of the Kaypro 386 is more than one-eighth inch longer than it should be, a sign of lowered construction quality, though the presence of a Phoenix Technologies BIOS gives assurance that, electronically at least, all is well. Kaypro has thoughtfully designed all expansion slots to accept full-length, full-height AT boards.



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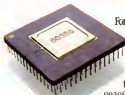
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Speed	32 bit, intel 80286, 10MHz clock speed	32 bit, intel 80386, 10MHz clock speed
System Memory	540 up to 1040 standard L1M support	540 up to 1040 standard L1M support
Storage Devices	1.2MB FDD 40MB HDD + 20min average access time	1.2MB FDD 40MB HDD + 30min average access time
Compuconner Support	80287	80287
Keyboard	Enhanced 101- key with tactile feel	Enhanced 101- key with standard Compaq feel
Warranty	One year Includes 4 month on-site service by TRW	One year Service at dealer site
Suggested List Price	\$2995	\$4495
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CIRCLE 177 ON READER SERVICE CARD

■ 386 COMPUTERS

Kaypro chassis is more than one-eighth inch longer than it should be. Although card guides are provided for every slot, standard full-length expansion cards fall short of reaching them, leaving long boards loose at one end.

Electrically, however, little fault can be found with the quality of the Kaypro 386. The screwed-in system board is straight from the Intel factory, with a Phoenix Technologies BIOS in place.

The 80386 microprocessor operates at 16 MHz and can be slowed to 8 by pressing the right keystroke combination. Sockets are provided for adding either an 80287 or 80387 numeric coprocessor.

ROOM TO SPARE As with other computers based on the Intel board, the Kaypro 386 provides two XT-style 8-bit expansion slots, four 16-bit AT-style slots, and two that use Intel's proprietary 32-bit expansion bus. In the Kaypro, all slots are full length (and then some) and tall enough so that any full-height AT expansion board fits with room to spare. In all models, one 16-bit slot is occupied by a Western Digital WD1003 combined hard-and-floppy-disk controller.

Built into the system board are a single serial port and a parallel port. Kaypro provides connectors for both—an AT-style male DB-9 for the former, a female DB-25 for the latter—attached directly to the rear of the chassis.

System board memory is 512K in two banks of 256-kilobit chips using a full 32-

bit data bus. Kaypro provides for memory expansion in the guise of two cards, one holding 2 megabytes, the other 8. The first expansion board must be the former, which allows total 32-bit-wide memory expansion under Kaypro's scheme of 2, 8, or 10 megabytes.

■ **Electrically, little fault can be found with the quality of the Kaypro 386. The system board is straight from Intel.**

According to the Kaypro setup procedure, a program run through DOS, normally only the first 512K of RAM is assigned to DOS; the balance of the memory is consigned to the extended addressing area of the 80386.

Standard with the Kaypro 386 is a single, high-density, 1.2-megabyte, 5¼-inch floppy disk drive. Optional factory-equipment hard disks span the range from 40 to 330 megabytes, and Kaypro supplies Storage Dimension's *SpeedStor* hard disk set-up software to partition the disk space. The evaluation machine was equipped with a Priam ID-40 hard disk, a 40-megabyte drive that turned in an excellent performance with an average access time of about 27 milliseconds.

The Kaypro keyboard, made by BTC (Behavior Tech Computer of Taiwan), was the most disappointing aspect of the system. It was disappointing to type on, with no tactile feedback and only a feeble electronic click from the system unit for audible feedback, and its layout differed just enough from the standard 101-key IBM Advanced Keyboard to make things troublesome. In particular, Kaypro enlarged the **Enter** key, pushed **Backslash** down next to the **Spacebar**, and added an extra macro key to the confusion left of the **Spacebar**.

Standard equipment includes neither monitor nor adapter. Optional selections include monochrome, color, and the good-

quality EGA system with which the evaluation unit was equipped.

Although Kaypro needs to make improvements in its 386's mechanical construction, the Kaypro 386 will outperform any ordinary AT two to one. That's the best recommendation of this—or any 80386-based—computer system.

LASER DIGITAL

Laser Digital Pacer 386

If there is a standard workhorse computer today—outside of those bearing the IBM label—it's the small-shop, off-the-shelf AT-look-alike with some degree of souped-up performance. Laser Digital takes that basic concept and packs it with the extra punch of 80386 performance to make the Pacer 386.

The styling of the Pacer 386 shows a strong influence of standard AT practice: only the front-panel ventilation slots have been swiveled 90 degrees (they run horizontally), the yawn of the floppy disk drive bay widened to triple-half-height, and the left-hand control panel augmented, all perhaps to skirt whatever design protection IBM might claim for its original.

Except for the front panel, the exterior differs little from AT style—big, red power paddle at the rear of the right side, power-in and switched-power outlet at the left of the back panel, keyboard connector stage center, expansion slots on the right. Only a few additional holes, half of them



FACT FILE

Kaypro 386

Kaypro Corp.
533 Stevens Ave.
Solano Beach, CA 92075
(800) 452-9776

List Price: Model A, with 1 Mbyte RAM, 1.2-Mbyte floppy disk drive, \$4,495; Model E40 with 40-Mbyte hard disk drive, \$5,795; Model E130 with 130-Mbyte hard disk drive, \$8,095; EGA monitor and card, \$920.

In Short: Kaypro is certainly a name you can trust (and a name you pay for), even though this machine could use some design refinements.

CIRCLE 488 ON READER SERVICE CARD



FACT FILE

Laser Digital Pacer 386

Laser Digital
1024 Morse Ave.
Sunnyvale, CA 94086
(800) 846-4225
(408) 747-1966 (in Calif.)

List Price: With 40-Mbyte hard disk drive, monochrome monitor, MS-DOS, disk caching software, \$4,095; EGA monitor, \$516; EGA card, \$395; 2-Mbyte memory expansion, \$695; 70-Mbyte hard disk drive, \$600.

In Short: The Pacer 386 is composed of quality parts assembled into a steady machine that performs on a par with other machines built around the Intel motherboard.

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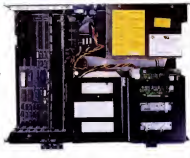
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► Only two of the Laser Digital Pacer 386's three front-panel LEDs are connected to anything, indicating drive activity and power on. The system board is the Intel standard with room for a coprocessor and eight expansion slots. The keyboard gives a pleasant surprise: a touch that is very close to the official IBM feel.



blanked off, have been added for extra communications connectors. There's even an FCC Class A certification sticker.

On the front-right side are three 5 1/4-inch, half-height drive bays, all with front-panel access, a hidden internal full-height drive bay, and a control panel left over from some other machine. Of its three LEDs—labeled HD, Normal, and Turbo—only the first two are connected to anything, indicating drive activity and power on. Below them are a round system keylock (which does not prevent cover removal) and a square white reset button.

Pull the cover off, and you'll find the

top of today's stock computer parts: an Intel 80386 system board and a Skynet Electronic (Taiwan) 192-watt power supply. Semipermanently taped to the side of the chrome power box is a 6-volt lithium battery to power configuration CMOS memory and the system's time-of-day clock.

As in other computers where it's used, the Intel system board endows the Pacer 386 with an 80386 operating at 16 MHz with one wait state for memory accesses and an expansion bus that runs at half that speed, 8 MHz. For compatibility with delicate software, the 80386 can be slowed to that rate with a keypress.

A socket is provided for an 80287 numeric coprocessor, which Laser Digital filled on the evaluation machine.

The Intel board provides for only 512K of system RAM, all allocated to DOS. Parallel and serial ports are built into its circuitry, which Laser Digital extends to the rear panel using plainly marked connectors, a male DB-25 for COM1 and a female DB-25 for LPT1.

Expansion slots number eight: two 8-bit, four 16-bit, and two using Intel's proprietary 32-bit bus. Standard slot filling includes a Western Digital WD1003 combined floppy-and-hard-disk controller in a 16-bit'er. In the evaluation machine, one 8-bit slot was filled with a Paradise Systems AutoSwitch EGA card, and a 32-bit slot hosted 2 megabytes of expansion memory, all configured in the 80386 extended addressing range.

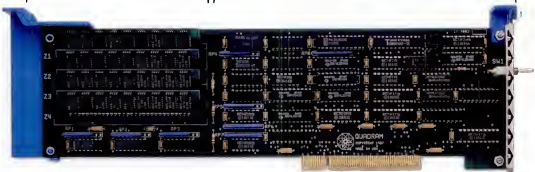
Standard mass storage includes the usual 5 1/4-inch, high-density (1.2-megabyte) floppy disk in the top slot. The evaluation machine came to us equipped with an optional second floppy—a double-sided, double-density (360K) unit—and a full-height Toshiba 70-megabyte hard disk in the internal bay.

COMMENDATIONS This hard disk proved to be commendably fast, with an average access time of under 26 milliseconds. All drives install with AT-like mounting rails, secured by small brackets hidden by the front-panel bezel.

The Laser Digital keyboard, manufactured by Chicony Electronics Co. of Taiwan, proved to be a pleasant surprise. It achieves a touch that is the closest to the official IBM feel of any tested here. It also sports a genuine mechanical keyclick and positive over-center feel. Key layout matches IBM's 101-key Advanced Keyboard design.

Accompanying the Pacer 386 was an impressive green IBM-style binder containing an assortment of software and documentation. MS-DOS was represented by program disks, a complete user guide, and reference manuals. In addition, Laser Digital supplied a disk with a program to set up the system's CMOS configuration memory, EGA utility programs to go with the system's Taming monitor, and Multisoft's *Super PC-Kwik* caching disk accelerator

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■ 386 COMPUTERS

program (which uses DOS, expanded, or extended memory). In fact, the only thing lacking was a manual covering the setup and operation of the Pacer 386 itself.

As an Intel-based 80386 machine, the performance rates of the Pacer 386 are entirely unremarkable—but only compared with the rest of this elite group. As an inexpensive entry into the world of high-performance computing, it is as a solid, workable choice.

PC DISCOUNT

PC Discount Noble 386

High-power portability—the idea is compelling enough that well-known manufacturers such as Compaq and Toshiba have crammed high-speed 80286 power in small, totable boxes. Not to be outdone, PC Discount has filled a case about the size of the original Compaq Portable with an 80386 system running at 16 MHz with one wait state. For the first time you can put mainframe power under your arm—if you don't mind your arm becoming somewhat longer from dragging this 30-odd-pound anchor-with-a-handle across the countryside.

The Noble 386 is actually a simple concept: an Intel 80386 system board stuffed not too successfully into a standard luggage plastic case. The standard memory endowment is 512K, all assigned to DOS, accessed through a 32-bit bus, and located on the system board.

The keyboard becomes the cover over the front-panel vitals—the monitor and



► Remember the original Compaq portable? Well, look again because PC Discount has resurrected the look (and the weight) of the Compaq but given it the innards of a 386. Though portable and powerful, however, the PC Discount Noble 386—with its slow hard disk and crowded insides—requires considerable additional fine-tuning.



FACT FILE

PC Discount Noble 386

PC Discount
2758 Bingle Rd.
Houston, TX 77055
(800) 843-7042

List Price: With 512K RAM, 360K floppy disk drive, 20-Mbyte hard disk drive, \$2,999; 40-Mbyte hard disk, \$400; 1.2-Mbyte floppy disk drive, \$140.

In Short: The Noble 386 is certainly the fastest luggage computer you can buy, but that benefit may not outweigh the lightweight construction of the machine.

CIRCLE 181 ON READER SERVICE CARD

drive slots. Two doors at the rear of each side of the system provide access to power connectors and expansion-board retaining brackets.

The front panel hints that the portable adaptation of the Intel board was made in haste. While the front panel engineered into the case provides space for two controls at its lower left, in the Noble 386 configuration one is used for a screen brightness control and the other is blocked off. What is supposed to be a reset button to the right of the screen does nothing but glow. The hard-disk activity light, which shines only from the bezel of the drive unit itself,

stays continuously lit, no matter what the drive is doing. And the case—a flimsy, unreinforced plastic that doesn't inspire confidence—provides so little interference protection that passing FCC Class B testing will be a difficult task, although PC Discount says they have received Class A approval.

The Noble 386 has its strong points, however, including a pretty good built-in amber cathode ray tube (CRT) display that measures 9 inches diagonally and is driven through a high-resolution (720- by 350-pixel) Hercules-compatible monochrome/graphics adapter.

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■ 386 COMPUTERS

The system unit allows the installation of three 5¼-inch, half-height devices, all with front-panel access. The evaluation unit was equipped with one 1.2-megabyte floppy disk drive, a 360K double-sided, double-density floppy drive, and a 20-megabyte Tandon hard disk.

Compared with the lightninglike 16-MHz (downgradable to 8 MHz by keystroke command) 80386 performance of the Noble 386, this hard disk was a major frustration. Its average access time tested at about 60 milliseconds, lackadaisical indeed, and a cause for much delay in disk dealings.

The keyboard, too, was bothersome. Its layout matches that of the original 84-key AT design, but its feel is closer to that of a Tandy Model 100—linear with neither audible nor tactile feedback. The indicators for the locking shift keys peer through the plastic case unmarked.

SLINGSHOT CABLE The keyboard cable is just short enough to be frustrating. You can pull it no farther than 2 feet from the system unit without it snapping back like a slingshot. And it's permanently attached: The cable is connected through a hole in the front panel, but it is virtually impossible to stuff the coiled cord back into the hole after it's been pulled out.

As you would probably expect for a compact case that has to host a whole computer and display system, it's crowded inside the Noble 386 chassis—so crowded, in fact, that many of the Intel system board's slots are unusable. Because one 16-bit slot is filled with the Western Digital combined floppy-and-hard-disk controller and an 8-bit slot is filled with the monochrome graphics card, only two 16-bit, one 8-bit, and one 32-bit slot are available for expansion boards.

The circuitry for the built-in parallel and serial ports is part of the system board. Connectors, a female DB-25 and male DB-9, are mounted on the retaining bracket associated with an unusable slot.

Although no space is provided for stowing the removable power cable, you can sort of stuff it behind the sliding access panels.

The evaluation system even proved to be somewhat cantankerous. At first it would not boot up and instead splashed

random characters across the screen. A little twiddling with boards and cables cleared that up, at least temporarily, but the problem sneaked back every so often.

All that said, the Noble 386 proved to be a useful, if somewhat ornery, computer. Its all-in-one design makes it convenient to carry about (with labor) and set up for instant use. If it can squeak through the FCC tests and live long enough to get its problems solved, it will be a workable, high-performance computer.

PC'S LIMITED

PC's Limited 386-16

More than anything else, the PC's Limited 386-16 is designed for speed. Although its 80386 microprocessor is limited to operating at its design maximum rate of 16 MHz, the same as nearly all the other machines reviewed here, PC's Limited has used several still-unique strategies to coax more performance from the system.

One is the elimination of memory wait states. Conventional DRAM (dynamic random access memory) chips cannot cycle fast enough to keep up with a 16-MHz 80386, so most manufacturers put the microprocessor on hold (a wait state) to let the memory keep up. While some other companies, notably Acer, Compaq, and

Tandy, use clever tricks to make their memory look (and work) fast most of the time, high speed is a full-time endeavor for the 386-16.

In effect, PC's Limited has turned its whole memory quota into a super-performance buffer, using high-speed static RAM for everything. This strategy is more costly but boosts memory-access performance anywhere from 15 to 50 percent over conventional dynamic RAM, depending on the application.

All of the static RAM in the PC's Limited 386-16 is held on a special 32-bit expansion board, which in turn embraces 32 sockets for 256-kilobyte static SIMMs (single in-line memory modules), allowing up to 8 megabytes. More memory can be added as conventional 16-bit DRAM boards in the other expansion slots.

Standard equipment fills four of the static RAM banks for a total of 1 megabyte, normally split 640K to DOS, 384K to extended memory. The proprietary static SIMMs are available from PC's Limited at roughly twice the cost of dynamic RAM modules.

TWO-SPEED EXPANSION BUS PC's Limited also boosts the performance of the 386-16 by allowing you to switch the speed of its expansion bus between 8 and 12 MHz. Even the fastest 80386 computers run their memory expansion bus at 8 MHz to retain compatibility with slower expansion cards. PC's Limited gives you the option of boosting expansion throughput by 50 percent with boards that will operate at the higher speed. This increase can be particularly important for hard disk controllers, increasing their effective throughput and the speed of disk-to-RAM transfers.

Even the BIOS, which bears a PC's Limited copyright, is custom-designed for speed. It uses four ROM chips to achieve full 32-bit bus width without copying code into RAM.

The PC's Limited setup routine also allows the elimination of memory refresh cycles—unnecessary with static RAM—which boosts performance a few percentage points more. In addition, another option allows the substitution of faster BIOS calls for some EGA functions (with the sacrifice of full IBM EGA compatibility).

PC QUALITY EDITOR'S CHOICE FACT FILE

PC's Limited 386-16

PC's Limited
1611 Headway Circle, Bldg. 3
Austin, TX 78754
(512) 339-6800

List Price: With 1 Mbyte RAM, 1.2-Mbyte floppy disk drive, 40-Mbyte hard disk drive, monochrome monitor, \$4,499; 40-Mbyte EGA system, \$4,999; with 70-Mbyte hard disk drive, monochrome monitor, \$4,899; 70-Mbyte EGA system, \$5,399; with 150-Mbyte hard disk drive, monochrome monitor, \$5,899; 150-Mbyte EGA system, \$6,499.

In Short: PC's Limited's decision to use only static RAM has led to a 386 that leaves the competition in a cloud of dust. Even though the technology costs more, the final price of the computer is extremely competitive.

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► You can practice your grammar with the PC's Limited 386-16—fast, faster, fastest. This machine is engineered for speed above all. Mechanically, it follows obediently in the footsteps of the original AT's design. The system board is compact, about XT size, owing to the use of VLSI circuits.



to increase the 386-16's display speed.

Mechanically, the PC's Limited 386-16 locksteps with conventional IBM PC AT design. The chassis size matches that of the AT, and its layout duplicates the original IBM design with a single full-height internal drive bay and three half-height bays on the right, two of which have front-panel access.

BEVELED CASE The largest styling difference is the beveling of part of the left top edge of the case to accommodate PC's Limited's well-known SmartVu diagnos-

tic display, a four-digit green LED panel that shows error messages and disk track accesses.

The rear includes connectors for AC power input, AC power to a display, and a keyboard connector cutout, in addition to the expansion slots. The on/off switch for the 200-watt power supply is the typical big red paddle sitting on the right side of the chassis.

The PC's Limited 386-16 system board inside is compact, about XT size, and sparsely populated, which is attributable to the use of both the Chips and Technologies

and proprietary VLSI circuits.

Also saving system board space in the PC's Limited design is the placement of all memory on an expansion board using a proprietary 32-bit bus. The single connector for this bus is located in the midst of the rest of the expansion slots, which, according to PC's Limited, is an optimal (rather than convenient) location that permits the maximum possible memory speed.

The system board also provides seven other slots, two 8-bit and five 16-bit. One of the 8-bit slots is filled with a parallel and serial port card (using a female DB-25 and male DB-9 connector) as factory equipment.

In the evaluation machine, two 16-bit slots were occupied by disk drive adapters, one for the floppy drive (a 1.2-megabyte, 5¼-inch half-height is standard equipment in all models) and another to provide an ESDI hard-disk interface. An optional 150-megabyte, full-height Control Data Corp. (CDC) ESDI drive in the internal drive bay of the evaluation machine required this adapter. Other, lower-priced drives use the standard ST506 interface.

The CDC unit is among the fastest hard disks available, with an average access time of about 17 milliseconds and a 10-MHz rated data transfer rate—twice the rate of a standard AT's.

The standard keyboard is manufactured by Maxi-Switch and uses the 101-key IBM Advanced Keyboard design. Its rubber-dome technology gives a satisfying over-center feel. It is reasonably quiet, with no true audible feedback, and is entirely satisfying to type upon. However, PC's Limited is in the process of selecting a new keyboard supplier.

All PC's Limited 386-16 systems are sold with display and adapter, either monochrome/graphics or EGA, using its own brand of displays and adapters. The 386-16 has received FCC Class B certification.

The 386-16 rates as the performance leader of the machines examined here, particularly when its advanced options—high-speed expansion bus, no refresh waits, and EGA enhancements—are used. Its construction rates near the top of the list, and its under-\$5,000 price makes it the best overall value in current 80386 technology.

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- Two serial ports and one parallel port
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TANDY CORP.

Tandy 4000

The new 4000 marks the next step up from Tandy Corp.'s 3000 series, essentially doubling the performance of the earlier machines while fitting into nearly an identical system unit case, 6 by 19 by 18 inches (HWD). As with the previous Tandy computers, it incorporates both novel technology (interleaved memory) and mass-market philosophy akin to that of Detroit in its heyday.

Although currently the most compact 80386-based PC (a bit deeper but substantially narrower, too), the Tandy 4000 still has enough width for a workable amount of mass storage. Its single drive bay will accommodate three half-height, 5¼-inch form factor devices.

Styling has been subtly updated from the 3000 to the 4000. The plastic front bezel is visually segmented into a stack of three slender bands, delineated by shallow grooves in the front panel that unite the look of its trio of drives to that of the overall system.

On the left are a power-on indicator, a red, rectangular, recessed, system-reset button; and a flat keylock that prevents cover removal, locks the keyboard, and defeats the reset switch.

The rear of the chassis looks bare. Only the expansion slots, a jack for a power ca-



▶ The case of the Tandy 4000 may match that of its 3000-series predecessor, but its performance is effectively double that of the older model, and not just because of the 16-MHz clock speed. For example, add a second megabyte of RAM to the system board and the 4000 interleaves its memory banks, increasing performance 20 to 25 percent.



FACT FILE

Tandy 4000

Tandy Corp.
1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700

List Price: With 1 Mbyte RAM, 1.44-Mbyte 3½-inch floppy disk drive, serial and parallel ports, keylock/chassis lock, \$2,599; EGA monitor, \$699; VM 5 monitor, \$149.95; 4037 EGA adapter board, \$299.95; 20-Mbyte hard disk drive, \$599; 40-Mbyte hard disk drive, \$1,399; internal disk cartridge system, \$1,799; hard disk controller, \$349.95.

In Short: The 4000 is in line with the competition in both price and performance. The 3½-inch microfloppy drive that comes standard is a unique departure for Tandy.

CIRCLE 679 ON READER SERVICE CARD

ble, and a recessed slide switch for selecting 110- or 220-volt operation are visible. Power is turned on using a gray rocker switch at the rear of the right side of the machine.

The interior of the case appears dominated by the large, 192-watt switching power supply, isolated in its own unfinished metal case. To its left are the expansion slots, which end almost 3 inches behind the front panel with a molded plastic bracket that provides card-edge guides for each slot and mounting room for the 2-inch loudspeaker. Without a great deal of effort, Tandy could have saved nearly 3 inches of depth merely by trimming the power sup-

ply case and flattening this bracket.

The system board itself is built around the Chips and Technology chip set and amazingly few discrete circuits.

Standard system board memory is 1 megabyte, 32 bits wide, implemented with four SIMMs (single in-line memory modules) tucked under the expansion boards at an angle to assure adequate clearance. Four more sockets are allowed for expanding on-board memory to 2 megabytes, all using 256-kilobyte modules. A future upgrade to 1-megabyte modules, which Tandy promises, will allow 8 megabytes of system board memory.

The first 640K of the standard mega-

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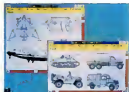
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For additional information about Windows DRAW, call your local authorized dealer, or call toll-free 1-800-272-DRAW (in Texas, 214-234-1769) or write to Micrografx, Inc., 1820 N. Greenville Ave., Richardson, Texas 75081.

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EDITOR'S CHOICE

- Compaq Deskpro 386
- IBM Personal System/2 Model 80
- PC's Limited 386-16

The slickest and best-built 386—and probably the best personal computer currently available—is IBM's PS/2 Model 80. Although not the fastest in testing, it proved to be the best integrated and the most responsive machine overall—a delight to work on. Physically, it makes other computers (including IBM's own PCs, XT's, and AT's) look like they were made in your neighbor's garage. With its \$6,995 price tag, however, it should.

If compatibility with current software and hardware is an issue with you (and your budget will stretch to \$6,499), go for the Compaq Deskpro 386. However, the PC's Limited 386-16 edges out the Compaq when it comes to raw horsepower; its rough edges are few, and at \$4,499, it's a bargain. Thus, for its price and no-holds-barred speed, we'd rate the PC's Limited 386-16 as the best buy of all those here.

Close on its heels in the performance department and priced a few bucks less are the \$3,995 Acer 1100 and the Tandy 4000 (\$2,495).

Tandy boasts the advantage of having a store almost as near as your doorstep no matter where you are, so if you need immediate support or immediate gratification, make the 4000 your choice.

Also in the top tier of quality is the ALR 386/2. The various machines based on Intel's OEM system board rate about a notch lower with their 512K of DOS memory and more plebeian performance, merely twice as fast as an AT. Of these, the best built comes with the Corvus name. If you need Class B FCC approval and yearn for the Intel standard, however, your only choice is the Kaypro 386.

Of the others, we found the quality of construction definitely lower but performance unflagging. Some of the bottom-rung 80386 machines, we believe, may never meet FCC standards. At a favorable price, however, those that prove legal may be exactly what a computer hobbyist or experimenter is looking for—speed and 80386 potential at the lowest price.

byte of memory is assigned to DOS. The rest appears invisible—it cannot be used as extended memory. However, Tandy cleverly uses this "phantom" RAM to copy and speed up BIOS routines. Up to 304K of it can be used as EMS using a special device driver provided with the 4000.

The 80386 microprocessor operates at 16 MHz and occupies itself with one wait state while addressing the standard memory configuration. Fill the system board with a second megabyte of RAM and the 4000 interleaves its memory banks, effectively eliminating wait states and increasing overall performance 20 to 25 percent on some applications.

EXPANDING MEMORY The leftmost expansion slot is dedicated to further expanding memory using a proprietary 32-bit bus. Next to this slot are two XT-style 8-bit slots, one occupied in standard configuration by a parallel-and-serial-port adapter card.

Next on the right are six (all vacant in the base model) AT-style 16-bit slots. The entire expansion area is tall enough to allow the use of full AT-height boards. All slots are full length.

The number of vacant chip sockets on the 4000 we evaluated made us suspect that somehow we had been shortchanged. In addition to a place for an 80287 numeric

coprocessor and another for a PLA (programmable logic array) to make it work, enough holes were available to accommodate an 80387 socket and a 765 floppy-disk controller socket.

Tandy doesn't give you your choice of coprocessors, however. Early 4000s will use the 80287 and later models will use the 80387. The double-socketing is only an engineering expedient.

In base configuration, the 4000 uses a floppy disk controller that's built into the system board circuitry—that's what the 765 socket is for. Upgraded models use a Western Digital combined hard-and-floppy-disk controller located in one 16-bit expansion slot.

With floppy disk control on an expansion card, the 765 chip on the motherboard would be superfluous, so Tandy lets you pop it out (or Tandy will do it for you). A system board jumper allows both sets of floppy disk control circuitry to be used to run up to four floppy drives.

Standard equipment includes one 1.4-megabyte, 3½-inch floppy disk drive adapted to the top slot. A second drive of any standard, IBM-supported configuration can be mounted underneath.

These drives all mount without AT-style rails, using only the normal tapped mounting holes provided in drives themselves. Because the screw on the left side may be difficult to insert and remove when expansion boards have been installed, Tandy supplies drive kits with special knurled screws that can be attached without tools.

The bottom half-height drive bay is reserved for a hard disk and uses a proprietary, shock-mounted installation system. All Tandy hard disk drives designed for the 4000 include the proper mounting hardware. Tandy drive kits also include the necessary controller card. However, their price is high—about \$1,700 for the high-performance, 28-millisecond average access time, 40-megabyte unit in the evaluation system.

The standard equipment parallel and serial ports are implemented on a single short expansion card that uses the IBM 8-bit data bus. The serial port operates at up to 9,600 bits per second, uses an AT-style male DB-9 connector, and can be configured as either COM1 or COM2 using on-board



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CIRCLE 346 ON READER SERVICE CARD

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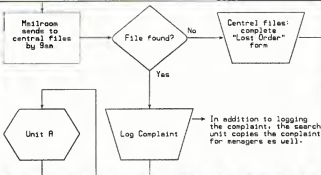
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* March 10, 1987 issue, page 278

Rush orders are shipped by Parcel Post and normally arrive the following business day by next business day delivery service.



The chart fragment above was produced on an HP LaserJet-Plus and is actual size and unretouched. Publication quality charts like this can be produced using only minutes of preparation time and seconds of print time.

CIRCLE 201 ON READER SERVICE CARD

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Order Desk: 1-800-267-0668
Information: (613) 544-6035 ext 49
Telefax(G3): (613) 544-9632

■ 386 COMPUTERS

jumpers. The parallel port uses a female DB-25 connector and can be jumper-configured as either LPT1 or LPT2.

The 4000 keyboard closely matches the 101-key IBM Advanced Keyboard arrangement. It's manufactured by Key Tronic using capacitive and rubber-dome technology to give long life and a positive over-center feel for tactile feedback. Its quiet, light touch makes typing easy.

■ Tandy doesn't give you your choice of co-processors. Early 4000s will use the 80287.

STANDARD EQUIPMENT DOS and GW-BASIC come as standard equipment with the 4000, as does Tandy's own *Personal Deskmate*, a starter software package. In addition, Tandy supplies a program called *The Monitor* that takes advantage of the abilities of the 80386 to handle multiple DOS sessions.

The Monitor divides up extended memory (in either 128K, 256K, or 512K chunks) between different DOS applications. All applications remain in memory simultaneously, and you can switch between them with a couple of keystrokes. The applications do not run concurrently, however. Only the program appearing on the screen executes; the others get put on hold.

Overall construction quality of the 4000 does not quite measure up to the high standard set by Compaq; this is in contrast to the excellent performance of the machine. In keeping with Tandy's mass market philosophy, the styling of the 4000 is still stuck in retro mode and pricing is not as low as it seems. The aggressive-looking \$2,599 price buys only the stripped base unit—no mass storage or monitor. Once decked out with a hard disk drive and display, its price is roughly competitive with the rest of the market.

Winn L. Rosch is a contributing editor of PC Magazine.

How to tell the difference between DESQview™ 2.0 and any other environment.

Selecting DESQview, the environment of choice, can give you the productivity and power you crave, without the loss of your old programs and hardware. If you like your existing programs, want to use them together, transfer data between them, print, sort, communicate with or process in-background, yet still have the need to keep in place your favorite PC(8088, 8086, 80286 or 80386), DESQview is the "proven true" multitasking, multi-windowing environment for you. Best of all, DESQview 2.0 is here now, with all the money saving, time saving, and productivity features that others can only promise for the all-too-distant future.

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SYSTEM REQUIREMENTS

IBM Personal Computer and 100% compatibles (with 8086, 8088, 80286 or 80386 processors) with monochrome or color display. IBM Personal System/2+ Memory 640K recommended; for DESQview itself 0.16K. Expanded Memory (Optional) expanded memory boards compatible with the Intel AboveBoard; enhanced expanded memory boards compatible with the AST RAMpage. Disk: Two diskette drives or one diskette drive and a hard disk. Graphics Card (Optional): Hercules, IBM ColorGraphics (VGA), IBM Enhanced Graphics (EGA), IBM Personal System/2 Advanced Graphics (VGA), Mouse (Optional): Mouse Systems, Microsoft and compatibles. Modem for Auto-Dialer (Optional). Hayes or Compatible. Operating System: PC-DOS 2.0-3.3; MS-DOS 2.0-3.2 software. Most PC DOS and MS-DOS application programs; programs specific to TopView 1.1, GEM 1.1 and Microsoft Windows 1.03. Media: DESQview 2.0 is available on either 5 1/4" or 3 1/2" floppy diskettes.

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CIRCLE 264 ON READER SERVICE CARD

Great projects start with great plans, and project planning is a perfect application for the PC. Here are 13 project management packages to help get you on track.

Project management is something akin to a juggling act of spinning plates. The juggler has to keep his eye on every plate at once, even as he runs around to make sure they're spinning fast enough not to tumble off their tiny stick perches. The project manager has to keep watch of every task and resource to make sure they stay on plan, or the whole project can spin out of control, resulting in time or cost overruns. It's a job that requires mental dexterity, a good sense of timing, and an understanding of the structural interrelationship of work tasks. It is a job that begs to be computerized.

Computers were first used for project management in the late 1950s during the U.S. Navy's *Polaris* submarine project (see sidebar "The History of Project Management"). By the early 1960s, large mainframe Critical Path Method (CPM) applications were being marketed commercially for mainframes. They cost as much as \$200,000 and were used on giant projects, mostly in the construction field. As has happened with all mainframe software, project management programs eventually migrated to the personal computer level and broader uses for the application became obvious.

Almost any job in business can be viewed through the filter of project management techniques. Doing so brings greater organization and efficiency, which translates into one of the most alluring words in the business lexicon: productivity. Today there are more than 100 project management programs available for personal computers. They range in price from about \$35 to almost \$8,000, but they all do basically the same thing: schedule various activities to help you make sure a project

MASTER PLANS: Project Management Software

■ PROJECT MANAGEMENT SOFTWARE

flows from start to expected finish with as few mishaps as possible.

CHARTS ARE CRITICAL At the heart of the project management process are CPM and the Program Evaluation and Review Technique (PERT). CPM is a method of scheduling a project based on accurate duration estimates for the critical activities. Critical activities are the ones that must start after others are completed and must end before others can begin. If a critical activity is started late, the whole project will be late. The PERT approach was originally used in situations where task durations were difficult to estimate. Project schedules were then determined by setting three durations—pessimistic, optimistic, and most likely—for each task. Today, CPM and PERT have become almost synonymous. PERT is most frequently used as the name of the network diagrams that show the critical path and the relationships between tasks. All personal computer project management software uses the CPM method for scheduling and the PERT chart to display task relationships.

Another important graphic tool of project management is the Gantt chart, which shows the tasks on a time line, revealing the impact of task durations on the ending date of a project. All the current project management programs can produce Gantt charts, and many of them use the Gantt chart as the central motif of the program. The comparison Gantt chart that shows both an original target schedule and an actual project schedule is the best and fastest way to check on project performance.

Because the Gantt and PERT charts are so important for project planning and tracking, the quality of the on-screen and printed graphs is one of the major distinguishing factors among programs. The quality does vary considerably, and the price of the package is not always an accurate guide to the quality of the graphics. You have to look to see what you like. The differences in price between packages often has more to do with power—that is, how many tasks and resources a project can have, the ability to handle multiple projects at once, how flexible the reporting facilities are, and how much detail you can get with cost data. If a program satisfies your basic power requirements, then the

graphics will be the way to pick the package that's right for you (for other feature considerations, see the sidebar "Project Managers: What to Look for When You Buy").

Personal computer packages fall into three general price ranges: under \$350, between \$350 and \$3,000, and over \$3,000. The under-\$350 group can only be used on very small projects, with little or no cost tracking. The really cheap ones might be a good way for project management novices to get a taste of what this type of software can do. The \$350-to-\$3,000 group con-

■ If a program satisfies your basic power requirements, then the graphics will be the way to pick the package that's right for you.

sists of full-blown project managers intended for departmental managers or other business and professional people who need to oversee projects but who aren't professional project managers. The over-\$3,000 group is for the professionals—people who do nothing but project management and generally work on extremely large and complex projects, such as developing a 40-acre tract of land for condominiums.

The midrange products are the ones that concern us here. They offer such good functionality that it's hard to justify going to the other ends of the market to buy a package. Even some of the lower-priced products in the midrange—those in the \$495 to \$595 area—can handle medium-sized to large projects, multiple project scheduling, automatic smoothing of resource use, and detailed reporting. They can be almost as feature-rich as the packages that cost \$2,000 and \$3,000.

All of the programs allow you to plan a project around tasks and milestones. To each of these activities you assign resources—people, equipment, and materi-

als—and to each of these resources you assign a cost. By balancing these activities, resources, and costs all at once, you can determine the most efficient course of action to complete a project on time and within budget.

To accomplish this goal takes more than excellent planning; it takes constant monitoring and fine-tuning as the project unfolds. This is the second major use of project management software. As tasks take longer, or new ones become necessary, or the availability or cost of resources change, the project manager can track what's happening with the project management program and alter his or her model accordingly. As he or she does so, the program will automatically reschedule the project to make the best of the new conditions. Most of the programs today will automatically recalculate schedules based on both critical path and resource usage. This latter technique, called resource leveling, has only recently become popular in personal computer programs.

Project management software is going through other changes as well. One major change is to upgrade the level of functionality—particularly in the packages at the lower end of the middle range. As more people use project managers and become familiar with their capabilities, they tend to demand more from the manufacturers. Examples of this are expanding the limits on total number of tasks and resources in a project, the ability to schedule tasks in time periods shorter than a full day—even down to minutes and seconds, the ability to vary pay rates for resources, the ability to level resources by availability or time constraints, more coding levels for better precision in reporting, and so on.

IMPROVING INTERFACES The program interfaces are also improving. More packages are using pull-down menus and windows. On-screen help is improving, becoming more context sensitive. Some packages now come with excellent, flashy interactive tutorials.

But in spite of the improvements in project management software, several areas have been neglected. Cost analysis is probably the most important of these. Most programs do a cursory job with costs. For example, many do only one kind of earned

PROJECT MANAGEMENT TERMS

Activity (task) Any of the basic jobs that must be done to complete a project.

ALAP Used to designate a task that should start as late as possible, using all the free float time available.

ASAP Used to indicate a task that should start as soon as possible, given the start date of the project and its predecessor tasks.

Baseline (target) The original project plan, including the time schedule and resource and cost allocations. It is used to compare actuals to determine a project's progress.

CPM (Critical Path Method) A project scheduling technique that helps in determining the early and late dates for individual product tasks and the project as a whole. If a critical task is delayed, the project deadline is pushed back.

Float The length of time a noncritical task can be delayed before it affects another task.

Gantt Chart A graphic representation of a project schedule that shows each task as a bar whose length is proportional to its duration. The bars appear in rows on a

time-line chart that covers the window of time in which the project occurs. Usually the bars are drawn in ways that indicate whether they are critical or noncritical, partly complete or altogether complete. The chart will also show the float time of noncritical tasks.

Histogram A vertical bar chart that shows quantities by time period. It is used to show cost and resource distribution over time.

Milestone A project event that represents a checkpoint, a major accomplishment, or a deliverable result. There is no time duration associated with a milestone.

Negative Float The amount of time a task was delayed before its actual start.

PERT Chart A graphic view of the predecessor and successor tasks in a project and the critical path. The chart resembles a flow chart or a network diagram.

Resource Any person, piece of equipment, or material used to accomplish a project task.

Resource Leveling The process of

smoothing out resource use between tasks in order to eliminate conflicts in availability.

Subproject A group of activities that fit together and could be considered a discrete whole. Subprojects then become another level in a project and can be nested within each other. A subproject appears as one activity on a Gantt chart. It is used for organizational purposes or to overcome activity limits in a program.

Superproject An overarching project composed of many subprojects. Superprojects can consist of nested subprojects or linked project modules.

Time-scaled PERT Chart A combination of the Gantt and PERT charts. It shows the typical network boxes of the PERT stretched out to reflect the duration, and laid out over a time scale.

Work Breakdown Structure (WBS) A diagram of a project's organization showing hierarchical levels of detail. Sometimes WBS code numbers are assigned to specific activities to facilitate later reporting.

—Henry Fersko-Weiss

value report, which measures the impact of costs on tasks in progress against a baseline budget. It would be better if there were at least two types of earned-value reports—one based on the percent of a task's duration that is complete, and another based on the percent of a resource that has already been used.

The next most important area left to future development is file compatibility. Many managers would appreciate the ability to exchange data between project management packages and other types of software—even applications run on minicomputers and mainframes. Today many packages allow you to export data to other personal computer programs, but few let you import data. And the export features in most programs need to be improved to support more proprietary file formats.

The last area that can stand improving is

the PERT chart. This very basic graphic approach, which has existed since the beginning of computerized project management, is still not handled as well as it could be. Most programs let you see too few tasks at once to be useful or show you so many at once that you can't tell which task is which. A number of manufacturers are working on improving this situation, but it will probably take a breakthrough in approach to make any real improvement in PERT chart quality.

The group of programs reviewed in this article all fall into the midrange. Just about any one of them could satisfactorily handle managing a project—but all of them have weaknesses that you will have to learn to overcome or work around. The on-screen graphics capabilities vary a great deal, and your opinion of the graphics will depend a lot on personal taste. If you're looking at project managers for the first time, you

should consider the areas outlined in the sidebar "Project Managers: What to Look for When You Buy." And you should look at several packages one after the other to make a good visual comparison.

Finally, one caution: don't think that a project management program will make managing a project automatic, or even particularly easy. It will make it easier, but you will still have to make quite an effort to plan carefully on paper first, input the original plan data, and keep the actual data up to date. In addition, you will have to spend time learning a program, no matter how user-friendly it is. The end results will be worth the effort, but there's no use in fooling yourself about the amount of effort involved.

Henry Fersko-Weiss is a free-lance technology and business writer based in New York.

PROJECT MANAGEMENT SOFTWARE



Project Management Software: Summary of Features

(Products listed in ascending price order)

	Project:Vision Immax International Publishing Ltd.	Microsoft Project Microsoft Corp.	Pro-Path-Plus SoftCorp	SuperProject Plus Computer Associates	PC Time Line Breakthrough Software	Project Scheduler Network Sciter Corp.	Harvard Total Project Manager II Software Pub- lishing Corp.
List price	\$349	\$395	\$495	\$495	\$495	\$575	\$595
RAM requirements	256K	256K	384K	320K	256K	320K	512K
File Import/export	ASCII, 1-2-3, dBASE	1-2-3, dBASE, SYLK	ASCII, 1-2-3, dBASE	Exports ASCII, 1-2-3, Super- Calc, CFC	1-2-3, dBASE, SuperCalc, Ready!, WordPerfect	Exports ASCII, DIF	ASCII, 1-2-3, dBASE, Time Line
Hardware Support							
Hard disk required	○	○	○	○	○	○	●
Mouse support	○	●	●	○	●	●	○
Printer/plotter support	●	●	●	Printer only	Printer only (plotter software sold separately)	●	●
Project Management Features							
Gantt	●	●	●	●	●	●	●
PERT	●	●	●	●	●	●	●
No. of activities per project	500	Limited by memory	500	Limited by disk space	1,000	2,000	Unlimited
No. of resources per activity/per project	20/100	8/255	8/60	Unlimited	12/unlimited	999/unlimited	Unlimited/100
Work breakdown structure	○	○	●	●	●	●	●
Resource leveling	●	○	●	●	●	●	●
Presentation							
On-screen reporting	●	●	●	●	●	●	●
Graphics included	●	○	●	●	●	●	●
Windowing	○	○	●	○	●	●	●

PC—Indicates Editor's Choice ●—Yes ○—No

Advanced Project Workbench

Advanced Project Workbench, from Applied Business Technology Corp., is designed for projects that use people as the only resource. The program has some unusual and good features, such as a split screen showing both a Gantt chart and resource usage spreadsheet, but its reporting facilities and Gantt chart are weak. At \$1,150 for the advanced version, this program is overpriced.

Project Workbench revolves around the Gantt chart. As soon as you've set up a project—by naming it and recording the start date—you go to the Gantt chart to en-

ter activities. As long as you are entering or changing task data, the Gantt chart will be the backdrop. The task and resource entry forms appear at the bottom of the screen.

You encounter the first unusual characteristic of *Project Workbench* at the first data entry field: the task ID. The way you code the ID allows you to enter three kinds of tasks representing different hierarchical levels in a project schedule. The highest level is Phase, followed by Activity, and Task. The Phase and Activity labels are actually two summary levels that aggregate time and resource use. You don't have to use them, but if you do, you can create reports specific to these levels and thus see a

project in large, more-manageable chunks.

However, *Project Workbench* allows for only these three levels, and that may not be enough for large projects. Plus, the Phase and Activity designations appear on the Gantt chart as blank rows under the time scale, which means you get fewer tasks displayed. The maximum number of rows on the Gantt chart is 12. So, if you have a few phases or activities displayed, then there are even fewer than 12 tasks, which is a narrow project window.

You can't sort on the ID field, so to code tasks you have to use another field in the data entry form, called Category. Using a ten-character code, you can identify tasks by department or by the people re-

Advanced Project Workbench
Applied Business Technology Corp.

\$1,150
\$12K
1-2-3, dBASE, dBASE, dBASE, dBASE, fixed format

Outsight Professional
Project Software and Development Inc.

\$1,495
\$12K
ASCII, 1-2-3, dBASE



ViewPoint Computer Aided Management

\$1,995
\$12K
Exports ASCII

Primavera Project Planner
Primavera Systems Inc.

\$2,500
\$12K
ASCII, 1-2-3, dBASE

SSP's Promis Strategic
Software Corp.

\$2,995
\$12K
ASCII, 1-2-3, dBASE

Plantrac Computerline Inc.

\$3,000
256K
ASCII, dBASE

○	●	●	○	○	●
●	Printer only	●	●	●	○
●	●	●	●	●	●
Limited by disk space	Limited by disk space	Unlimited	10,000	Unlimited	250,000
200/200	200/200	Unlimited	Unlimited	Unlimited	5/200
○	●	●	●	●	●
●	●	○ (separate package)	●	●	●
●	●	●	○	○	●

sponsible for managing them, and so on. Since you can sort on the category code by any one character or combination of characters, you can use this field to be fairly precise when it comes to reporting.

After setting the ID and naming a task, you move to the next entry field—Bus. Days—where you enter the traditional data on task duration. *Project Workbench* uses that information to produce task bars of appropriate length on the Gantt chart. In fact, task bars are lines of little squares—like cursor boxes—one for each day of a task.

RESOURCE ENTRIES However, the program uses other information for a duration column to the left of the time-scale

area on the chart. The number in this column is a sum of all the resource work days that are associated with a task. If there are three people putting in full work days on a task that takes 10 days, then the duration column would read 30, but there would be just the ten boxes in that task's bar on the chart. Or you might have a task that takes 10 days with only 6 man-days of work allocated to it, averaged over the 10 days. On the one hand, this dual treatment of duration supplies much more information—the total work effort—but on the other hand, you are forced to count the little boxes in a bar to see how long a task will take in real time.

There is room for only six staff resource

■ **Project Workbench's**
Phase and Activity
designations appear on the
Gantt chart as blank rows
under the time scale,
which means you get
fewer tasks displayed.

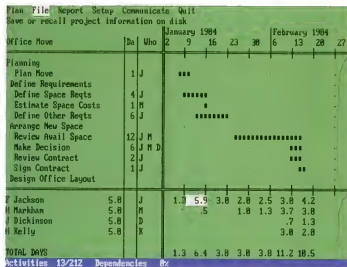
entries in the activity form. The only resources that the program is designed to detail are human resources. The resource blanks on the activity form are all labeled "Who."

As you enter the people resources, if the program doesn't recognize a person's identifying initials, it prompts you to enter that person's name into the system through an entry line that pops up at the bottom of the screen. The entry includes a person's name, his ID initials—displayed in a column right next to the duration column—the days per week he works and his daily rate of pay. Any equipment or material costs are entered as a lump sum for the task in a separate cost field.

What becomes clear from the way the program treats resources is that it's targeted at service-oriented projects. You could treat a piece of equipment as a person, determine its daily rate by hand, and enter it that way, but it would be awkward. And, on top of that, the reports would be misleadingly labeled and you would be able to assign a total of only six people or pieces of equipment to a task—limiting both severely. If your projects are centered on construction or manufacturing, this program isn't the right one for you. But if your projects revolve around people, services, and/or paper deliverables, then this program is nicely designed to eliminate extraneous issues.

PEOPLE CHARTS The main screen in the program, the Gantt chart, is actually a split screen that has a resource, or worker,

PROJECT MANAGEMENT SOFTWARE



The main graphics screen of ABTC's Advanced Project Workbench includes a Lotus-style menu across the top, a Gantt chart showing project times as a series of bars in the upper half of the screen, and a spreadsheet of resource allocations in the bottom half.

spreadsheet at the bottom. There is room on the screen to display five people at the same time. Their full names are on the far left, followed by the number of days a week they work, their initials, and the spreadsheet of their work effort. The columns of the work-effort spreadsheet correspond to the time-scale divisions in the

Gantt chart, either weeks or months—the program doesn't allow for finer time gradations on tasks.

Each individual's work effort is averaged over the length of the task and then prorated on the basis of the number of business days that task takes up in the time-scale segments. If a task starts in the middle of a week, the first column of the resource spreadsheet might read 2.0 or 3.0.

The spreadsheet becomes a little confusing when a person is assigned for fractional days of work. For example, if a task takes 13 days, and one individual is working on it but will put in only 10 days of work effort, then the average work effort on each day is .77 days. If the task starts in the middle of a week it will extend into three weekly time segments on the Gantt chart, resulting in a resource spreadsheet that would have three columns with numbers like 3.1, 3.9, and 3.1. Because the work load is averaged it may not end up equaling the whole number that appears in the duration column of the Gantt chart. A person's work load can be displayed in three ways: in days, in hours, or as a percentage.

If a person works on several tasks at once, the spreadsheet numbers are the sum of his or her work effort—prorated over the week (or month) of the time frame shown. When this number exceeds a person's assigned work effort limit, it will be highlighted in reverse video, so you can generally tell which jobs a person is working on in any one week. Then you can fix the problem manually or use the program's

■ If your projects revolve around people, services, and/or paper deliverables, then *Project Workbench* is nicely designed to eliminate extraneous issues.

Autoschedule command to reschedule the project automatically so a person is no longer overutilized.

Because the program is fixated on people resources, *Advanced Project Workbench's* cost reports are extremely limited. There are only two reports that can have cost data in them. The first is the Activity Plan Report, which prints out all the information about a project plan, including the fixed and people costs. The second is the Activity Status—Time and Cost Report, which compares actual costs against planned costs for each activity. These cost reports are a very simplified approach to cost analysis and tracking costs throughout the project.

The overall reporting facilities in the program are weak. There are only seven possible reports you can produce, and three of them are graphic: a Gantt chart (with the resource spreadsheet), a PERT chart, and a dependency definition diagram, which is hardly more than a PERT chart in another form. You can select and sort data that goes into these reports so they can be made more flexible, but still, they are limited.



FACT FILE



Advanced Project Workbench
Applied Business Technology Corp.
305 Broadway, 6th floor
New York, NY 10013
(212) 219-8945
List Price: \$1,150 (the

standard version is \$750).

Requires: 512K RAM, one floppy disk drive, DOS 2.0 or later.

In Short: *Advanced Project Workbench*, designed for projects that are centered on people, is useful for service-oriented companies. But its reporting features are weak and it seems overpriced. Not copy protected.

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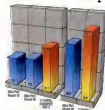
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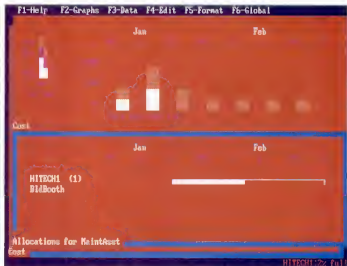
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Harvard Total Project Manager II

The opening menu in *Harvard Total Project Manager II* appears in a two-tone box with a pinstripe across it, and shadow outlining that gives it a three-dimensional look. The package is just as showy throughout. It uses color extensively in the menus and charts. Software Publishing Corp. has also added some slick new features, but there are serious failings in their execution. And perhaps because the package has such a graphic nature, switching between screens is slow, as is the recalculation of a project schedule. On the positive side, the program can produce very good reports and does a nice job of handling subprojects, nested to infinity.

With *Harvard Total Project Manager II* (HTPM II), \$595, you can approach a project from four different views: a work breakdown structure (WBS), PERT chart, Gantt chart, or task list. You can designate a default view that will automatically appear each time you start the program. You can also enter activity data in any of the views, although complete data can be entered only in the PERT format.

The first time you use the program it is set to have the WBS as the default project view. Not too many programs offer an on-screen WBS, yet it's ideal for broad-stroke



Graphics-oriented *Harvard Total Project Manager II* is designed for those users looking for a high-quality visual interface. Here, a split screen shows a cost graph on top and a resource allocation chart on the bottom.

project planning. It lets you scope out important phases and milestones in a project—the large-scale demarcations in a schedule. This is especially useful when starting a large or complex project. But a WBS is just an initial, rough view of a project. You can't use it for detailed planning or follow-up tracking of a project. These have to be done in a Gantt or PERT chart.

AUTOCHART The difficulty with HTPM II's implementation of WBS is that as you build the WBS view, a PERT chart is automatically drawn. Because you can't accurately specify the relationship between individual activities in a WBS, the automatic PERT chart can end up as a bizarre jumble of tasks and milestones. Plus, as you move from one level to another in the WBS it throws dummy milestones into the PERT chart. These "extra" milestones clutter up the PERT chart, making it harder still to get a grasp on the project.

Since there is no way to turn off the automatic drawing feature, you'll have to redraw parts of the PERT chart. While this is fairly easy to do, if you wait until the WBS is complete, the PERT can be such a

mess that it takes a lot of time to untangle. If, on the other hand, you frequently jump back and forth between the two, you lose time and risk interrupting your train of thought.

The Gantt chart and the task list have the same limitation as the WBS on entering accurate information for the sequencing of activities. If you want to use either as the main view into a project you will be forced to go to the PERT chart at some point to redraw task and milestone relationships.

Since the PERT chart is the only place you can enter a complete sequence pattern for activities, it is the logical place to build your project. So, having the four approaches, which seemed like great flexibility at first, is of limited practical value.

The PERT chart uses red and blue boxes to indicate activities on or off the critical path. Milestones appear in large boxes and tasks appear in somewhat smaller boxes. Beneath the boxes are lines of data called tags. The default tags are durations for tasks and early start dates for milestones. You can remove these data tags or add others—up to five. So, for example, you



FACT FILE



Harvard Total Project Manager II
Software Publishing Corp.
P.O. Box 7210
1901 Landings Drive
Mountain View, CA 94039

(415) 962-8910
List Price: \$595

Requires: 512K RAM (network versions require 640K RAM), hard disk drive, DOS 2.0 or later.

In Short: *Harvard Total Project Manager II* makes exceptionally nice use of color in its graphic menus and forms. It has good, flexible reports and handles subprojects well, but some of its other features are not fully fleshed out. Not copy protected.

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Release 1.0
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THE HISTORY OF PROJECT MANAGEMENT

Project management became a conscious modern science in the early 1900s. One of its founders was a man from Maryland, born in the early years of the Civil War. He went to university at an early age and then went on for an advanced degree in engineering. He worked as a consulting engineer to some of the largest U.S. corporations and for the U.S. Government. At the same time, he wrote papers on scientific industrial management. It was during another war, World War I, while working for the government, that he developed his now famous visual aid for work control, a variety of the bar chart that bears his name, Gantt.

Henry L. Gantt died just after World War I, but his bar chart became an accepted business tool by the time of World War II. The federal government was one of the most dedicated users of the Gantt chart, so it was only fitting that the next big development in project management happened in that arena. In the late 1950s, Dr. John Mauchly developed the Critical Path Method, which analyzes a project by focusing attention on the tasks that must be completed on time for the project

to meet its projected deadline. These critical tasks can't have any slack or float time.

Mauchly was better known for another invention that he worked on with several other men at the engineering school of the University of Pennsylvania—EDVAC (the Electronic Discrete Variable Automatic Computer), one of the earliest computers. It was finished in 1951. Mauchly's project management technique was further developed by Willard Frazer, a consultant on the *Polaris* submarine project, conducted in the late 1950s by the U.S. Navy. Frazer's contribution was called Program Evaluation and Review Technique, or PERT. In the original implementations of PERT, project tasks were given three time estimates for completion: a best case, a worst case, and a most probable. Over time, the three time estimates disappeared, and the name PERT came to be associated with the flow diagram that was used to represent the predecessor and successor relationships among project tasks.

So, today, the two most common graphic views of a project are the Gantt chart and the PERT chart. They were in-

corporated into the early project management programs that were written for mainframe computers. In the 1960s, project management got a big boost from the construction industry, which was one of its early and principal users. A group of powerful project management programs were developed in England and then later imported to the U.S. One of that group was *Plantrac*, which today has been rewritten as a personal computer program.

Over time, as with all mainframe software, versions of project management programs became available on the personal computer. The first PC program was called the *Harvard Project Manager*. It was introduced in 1983 by Harvard Software, which was acquired by Software Publishing Corp. in 1985. The *Harvard Project Manager* was quickly followed by other packages, and today there are more than 100 PC project management programs on the market. There has been a great deal of development in the few years since the first packages, and there is bound to be much more in the years ahead, particularly as 80386 PCs become widespread.

—Henry Fersko-Weiss

could include the actual start dates, the name of the person responsible for the task, percent complete, planned resource cost—or you could pick from a list of at least two dozen other tags.

Unfortunately, the PERT's activity boxes are large, and the tags make them even larger. They end up taking so much room on the screen that you can see only about six at once. (The most I ever got on the screen was eight, and sometimes I could see only two or three.) There is a zoom facility to give you an overarching view of the project, but in the zoom view, the boxes are tiny and it's hard to see which activities are which.

The Gantt chart displays six activities. This is limited compared to other programs that can show 18 or more activities at once. Even if you remove the tags from the Gantt chart, the activities remain double spaced

and there is no increase above six. The wide-open spacing in the Gantt chart makes it hard to grasp as a whole.

HTPM II uses pull-down menus and fill-in forms extensively. The pull-down menus slow the program's operation, but *HTPM II* has speed key combos that bypass the menus for some important functions or for jumping to different charts. Most of the speed commands are easy to remember. One of the oddities of this program is that you can't use a mouse with it. Since pull-down menus were originally designed for the mouse, and given the graphical nature of this program, this is very surprising.

As with other project management programs, one of the first forms you work with in *HTPM II* is the calendar. A standard Monday-to-Friday calendar comes with the program; workdays in this calen-

dar start at 9:00 A.M. and last 8 hours. You can create any number of other calendars, each specific to a particular project.

The calendar facilities in *HTPM II* are easy to use. There is a find date feature that lets you jump easily to any date, even years into the future. But this feature's implementation has also been stunted: you can indicate only work hours for the full workweek, not individual days. That means you can't specify half days—such as Saturday morning—or late days. This limitation can make it difficult to allocate people resources in situations where work days vary.

NEXT BUILDER *HTPM II* handles up to 200 or so resources per task—or until memory runs out. Each project can have up to 280 tasks. Both numbers are large enough for most projects you might man-

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■ PROJECT MANAGEMENT SOFTWARE

age. If they're not, you can always use the subproject facility to swell the capacity. You could have 280 subprojects in a superproject—in other words, the subprojects would each appear as one task—and each of those subprojects could have 280 tasks or subprojects, and you can keep nesting subprojects like little Russian capsule dolls, until the memory is exhausted.

To make working with subprojects easier, *HTPM II* stores the subproject files within the superproject so you can move quickly between the two. There is a Visit Subproject command on the F6-global menu that enables you to jump from the superproject right into a subproject and work there for a while. You return to the superproject with the Leave Subproject command. Whenever you make these leaps from one level to the next, *HTPM II* automatically saves the data you've created at the level you are leaving.

You can also create a subproject out of a group of tasks or link a number of mini-projects together into a superproject. These links can be sundered whenever you like.

The reporting options in *HTPM II* are very good. There are 14 types of text reports you can design by choosing the column headings you want and the order in which they should appear. You can also sort the data that appears in the rows. For example, if you're printing a Task Work Summary report, you could decide to print the report with the task names (the first column) organized according to planned start date, or name, or latest finish date, percent complete, actual start, and so on. You can select up to ten sorting parameters at once and specify either ascending or descending order.

Here again, however, Software Publishing has failed to take a very good idea to its logical conclusion: reports can't be viewed on-screen. Since many people want to track projects on-screen, this is limiting in itself. But it causes another problem as well—you can lose a great deal of time trying to decide on an ideal report format because you have to print out each variation before you can judge it. Printing a task summary report on a project with just ten tasks and five columns of data took a couple of minutes. And printing a Gantt chart of the same project took no less than

7 minutes in the low-quality mode.

HTPM II has much more promise than it is able to deliver in the end. Yet, the program would be good for someone who likes a high-quality visual interface and is willing to put up with some quirks.

Microsoft Project

When you start *Microsoft Project*, you come automatically to a blank Gantt chart with numbered places for 18 activities and a command menu at the bottom. This immediate thrust into the Gantt format reflects *Microsoft Project*'s most appealing characteristic—it is a straightforward program with a no-frills approach to features. Yet there is plenty of capability and a rather nice Gantt chart.

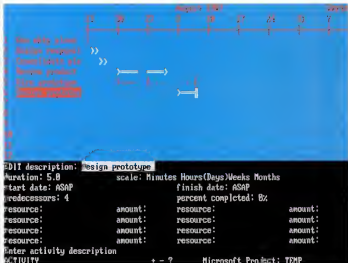
Before using *Microsoft Project*, \$395, for the first time, you can explore the program through the on-disk tutorial, which has excellent graphics, animation, and user feedback. Some 30 lessons teach you most of the program's capabilities. Each lesson starts off by telling you how long it will take, so you know exactly what you're getting into ahead of time.

The program hardly needs so many lessons because it is very simple to use. When

you are presented with the opening blank Gantt chart, there are two lines of commands at the bottom of the screen. The Edit command is highlighted, anticipating your desire to start entering activities for your project right away. If you press return, the bottom third of the screen is replaced by the activity form. The cursor is in the description field, where you use up to 40 characters to name or define the activity. The first 15 characters (this can be adjusted) of the description appear on the chart's task list.

You only have to name an activity to have it appear in the Gantt chart. So, if you're just sketching out a project, you can start by listing tasks and milestones as they occur to you. Once you're in the activity form you can continue to enter tasks without leaving. Just pressing the Cursor Down key will move the highlight in the Gantt chart to the next task number and the activity form will return to its blank state—waiting for the next task description.

Of course, you can enter more complete activity data right from the start. The form has fields for all the usual activity parameters: duration (by minutes, hours, days, weeks, or months), start date, finish



The activity form in the bottom half of Microsoft Project's Gantt screen has room for up to 40 characters to define activities.

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■ PROJECT MANAGEMENT SOFTWARE



FACT FILE

MICROSOFT

Microsoft Project

Microsoft Corp.
16011 NE 36 Way
Box 97200
Redmond, WA 98073
(206) 882-8080
List Price: \$395

Requires: 256K RAM,
two floppy disk drives, DOS 2.0 or later.

In Short: *Microsoft Project* is a good, straightforward program with no fancy features. It is easy to use and fine for small to medium-sized projects. Not copy protected.

CIRCLE 666 ON READER SERVICE CARD

date, predecessors, percent completed, resources, and amount of each resource used. For the start date you can specify ASAP (as soon as possible), ALAP (as late as possible), or the exact date. Activity predecessors are indicated by their number on the Gantt chart. Each activity can have up to 16 predecessors, making it easy to position an activity in its right place in the project. Multiple predecessors are separated by commas.

You can have up to eight resources per activity—a sufficient number for small to medium-sized projects, but not for anything larger. You could aggregate some resources, but this would make cost tracking more difficult and less precise.

With 512K or more of memory, *Microsoft Project* can have up to 999 activities. The capacity varies with the complexity of individual activities. If this isn't enough, you can link projects together, giving you virtually unlimited capacity.

FOR LARGE PROJECTS Projects are linked with the Xternal Link command. Once linked, they appear on a Gantt chart's activity list with an .ACT (actual) extension—just as if they were individual tasks. The linked projects' data is used to calculate the duration and finish date of the larger project they are in. Resources and resource costs are also carried over, if you want them to be.

A particularly useful linking feature in *Microsoft Project* lets you use the Xternal Use command to replace one linked file in a master project with another, allowing

you to customize a master project by substituting modular, small project pieces. In a similar fashion, you can use the Xternal Copy command to transfer a group of activities from one project into another, eliminating the need to rekey that information. Then you can adjust whatever activity data isn't exactly accurate—such as the start date or task predecessors.

The Gantt chart is the backbone of *Microsoft Project*. Its attributes make it a sturdy support for the rest of the program. To start with, you get to see 18 activities on the screen at once. The larger the window into a project the better, because it's important to see surrounding activities when you are examining or reassessing a particular task—especially at the tracking stage of a project.

The Gantt chart's marking symbols are easy to understand at a glance. They denote critical tasks, noncritical tasks, milestones, predecessors and successors (or both), and the percentage of completion. Another plus is the ability to sort activities by criticality. Secondary sorting filters are the earliest start date, actual start or finish dates, alphabetical order, or duration. By using the Original Order command, you can always return to the way things were before you started sorting.

When you first start the program, the time scale at the top of the Gantt chart is separated into weeks. It can be adjusted to smaller and larger blocks of time by using the Plus and Minus keys. The range goes from 15-minute intervals to half-year intervals.

Microsoft Project doesn't do as well with the PERT chart. In fact, its PERT chart is rather poor. What the program offers is a bare-bones version, called the Network screen. It shows which activities are critical and the relationships between tasks and milestones, but it is too simple to be anything more than a quick look at the structure of a project. The Network screen's one interesting feature is its ability to shrink activity boxes gradually so you can see more of the project flow at once. You can reduce the chart to simple flow lines and numbers for the activities, allowing you to see the whole project at once—unless it is extremely large.

After you plan a project you usually save that schedule as a forecast, which

adds an .FCT extension to the filename. *Microsoft Project* allows you to save any number of alternate forecast files or overwrite the original. You can see instantly how a forecast stacks up against the actual project by using the Analyze command. It splits the screen in half horizontally, displaying the forecast Gantt chart at the top (with eight activities listed), the actual project Gantt chart at the bottom (with exactly the same eight activities listed), and commands at the very bottom. The GoTo command provides synchronized scrolling and lets you move around the charts easily. You can also sort each chart individually or move activities around in both charts simultaneously, helping you to review or re-adjust the projects.

Another useful split-screen feature, the ResourceView, divides the screen vertically. On the left is a list of activities a particular resource is assigned to on a given date. It tells you the amount of the resource used, its peak utilization, and the capacity of the resource. On the right of the screen is a histogram (vertical bar chart) that shows the pattern of the resource's use over time. The scale of the chart can be changed, again with the Plus and Minus keys. Being able to look at resources with this split view helps you to reassign them during a project, if the need arises.

FLEXIBLE REPORTS *Microsoft Project* also allows you to create flexible project reports. Again starting with the Analyze command, you can choose and customize reports to be printed to the screen, disk, or printer. The reports compare actual and forecasted schedules from a variety of perspectives. You can tailor these reports to focus on a specific activity, resource, or range of dates. If you were to do a summary report on an activity, for example, it would be split into five sections dealing with the activity parameters, the start date, duration, and so on; its predecessors, successors, and how late or early they are; the slack-time available, and the resources used to date.

For tracking costs, you can export data to any spreadsheet program that uses a .DIF file, such as Microsoft's *Multiplan* and Lotus's *1-2-3*. You have to use a spreadsheet if you want to do any fancy cost analysis, because the program can't

PROJECT MANAGEMENT SOFTWARE

produce more than a straightforward resource/cost report. Also, the export feature would be more useful if you could export files in dBASE format as well.

Plantrac

As soon as you open the package you know that *Plantrac* is not a typical project management program. There are 14 program disks inside the plastic disk holders at the back of the introductory guide. Those disks, it turns out, hold 225 files that take up over 4.3 megabytes of your hard disk. The program's size and \$3,000 price tag are true reflections of its power and also the effort it takes to learn to use it. But once you've mastered it, *Plantrac* is not all that difficult to use and it offers one of the most complete approaches to project management.

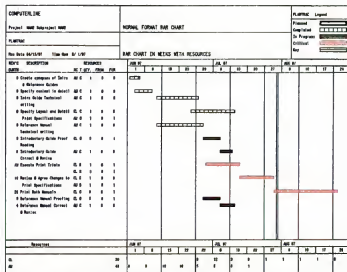
While there is a lot to get used to in this program, Computerline provides a host of materials to help. There is a start-up workbook that discusses the program's crucial features and how to get started using them. A separate demo disk runs through the basic program operations so you can get a feel for the different menus, handling activities, resources, costs, and reporting. And then there are the manuals: three of them. The introductory manual serves as another tutorial for the program.

FACT FILE

Plantrac
Computerline Inc.
P.O. Box 30852
School St.
Pembroke, MA 02359
(617) 294-1111
List Price: \$3,000
Requires: 256K RAM,
hard disk drive, DOS 2.0 or later.

In Short: *Plantrac* is definitely in the upper reaches of the power scale for project management programs. It offers very full-bodied features for scheduling a project and reporting on its progress throughout. Its on-screen graphics have some weaknesses, and the number of resources you can apply to tasks is limited. It is also relatively hard to learn. But if you need its power, then it's worth the effort and the expense. Not copy protected.

CIRCLE 667 ON READER SERVICE CARD



This sample plotter output of Computerline's *Plantrac* shows the program's capabilities in creating a Gantt chart with resource allocation information located below. Notice that critical, key, planned, and completed projects each have their own graphic design.

The main menu in the program seems daunting at first. Listed under four category headings—Subproject, Resource, Cost, and Others—are 35 different options. The Subproject options are the starting points for the first leg of project management: activity entry and scheduling. The Resource and Cost options are the other legs of the process. Looking at these three lists of options, it's interesting to note that Subproject is by far the longest, followed by Resource and lastly by Cost.

EXPORTING DATA Like most other project management programs for personal computers, *Plantrac* doesn't do as thorough a job on cost reporting and analysis as might be hoped. But like the other good project managers, *Plantrac* allows you to export data to 1-2-3, dBASE, SuperCalc, and other programs for further manipulation. You can even use the Others option (99 is the code for it) to export data to a mini or mainframe system.

Once you've selected the Create/Amend option from the Subproject menu, you go into an activity form. All of the ac-

tivity data is entered on one form. On the left part of the screen is the dependency list, which allows for up to 16 dependencies to be entered. There are some novel data fields, such as the activity type. There are five activity types: start, end, key, interface, and hammock. The first two are self-explanatory. A key activity is a milestone, an interface activity is one that is common to several subprojects and connects them, and a hammock activity is a summary of a group or series of activities for reporting purposes.

The cost field in the form lets you enter an overhead cost, which is a special cost to be added on top of the computed resource costs. The coding fields let you enter responsibility and cost codes—which are somewhat standard—but you can also enter two user-determined codes to be used for any coding purpose, such as connecting the data to an accounting program. The first of the user code fields holds up to 5 characters; the other allows for 16.

The activity form allows for the entry of only five resources. In a program that is obviously intended to handle large projects



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this is surprising. But the pool from which the five come can have 200 resources, and you can create as many resource files as you want for a project. You can have up to 2,500 activities per subproject, and 100 subprojects in a superproject.

One of the little extras that the power of *Plantrac* offers is the ability to reuse data from the last activity that was entered. By using the Quote Mark key you can copy over an individual field, or use the Tilde key to import an entire block of data.

Resources and costs are treated thor-

■ The most powerful part of *Plantrac* is its reporting facilities. All reports can be customized, and there is a complete graphics generator for charts.

oughly and thoughtfully in this program, but the entry routines aren't quite as neat as they could be—you have to go to several screens to input the resource data. The initial resource entry screen is a one-liner. You get to put in a resource code, a description, the length of the workweek, dates between which it will be available, and the quantity of resources (in a range from 0 to 3,000). To enter the cost associated with the resource you have to go over to the Cost Options menu and choose Create/Amend. There you enter costs by resource code, and you can specify what those costs will be if the resource is used or unused.

When the resource is finally allocated to a task, you specify the quantity, which can be expressed in man-hours, man-days, volume, or quantity. Next comes another one of *Plantrac*'s powerful detailing features: you can specify how that resource is applied to the task. There are three choices: C (for constant), if it's used every day of the task; S (for specific), if it's used every day, but only during a particular date range; and G (for general), if it's used for a

certain length of time spread out over the task duration. The two other fields on the resource part of the activity form let you specify when the resource will start to be employed in a task's time frame, and for how long.

POWERFUL REPORTS The most powerful part of *Plantrac* is its reporting facilities. In addition to a wide range of report formats, all reports can be customized and there is a complete graphics generator for plotting charts and diagrams. Take the selection options as an example of the range available in the reports. There are 18 choices altogether, including: Activities Using Specific Resource, Critical Path, Activities In Progress, Activities With Priority Less Than Specified, and All Activities Except Completed. All of these choices relate to project tasks. There are also report selections for resources and costs.

The reports can also be filtered through a date range, and you can control the order in which the detail fields appear on the reports. In the area of tasks there are 17 different data fields to consider, and the ones you don't want in a particular report can be suppressed. The data fields include the starting date, duration, float, priority, and so forth. You can actually control the column sizes for the data fields in the tabular reports and the ASCII characters used in the bar charts to represent critical tasks, completed tasks, float, and so on. The column headings in the tabular reports can be renamed to your liking, and once a report format has been customized the way you want it, you can save it for future use.

In addition to the bar charts for the project schedule, you can create resource histograms and a cost histogram, as well as a logic drawing that shows the relationships between tasks. None of these on-screen graphics are outstanding. They are limited to ASCII characters. It is clear that managing and monitoring projects with this program are meant to be done in tabular reports and through plotted output, not with on-screen graphics.

The cost-analysis features in the program are perhaps its weakest area, but Computerline offers a companion product called *Cost System* to handle work breakdown structure and job costing. Or you can

export the data to a spreadsheet program.

While *Plantrac* is anything but easy to learn, there are several program features that help in the process. All of the operational actions are performed with prompting or questions from the program. Messages at the bottom of the screen give you an idea what information is needed in a particular field, and in most situations you can press the Question Mark key to get a help screen.

All in all, *Plantrac* is one of the most powerful programs available. But that power does have a hefty price, so this program is only for those people who will use all its features to their utmost. Otherwise, less-comprehensive programs at a more reasonable cost would be better choices. *Plantrac* can be purchased in modules that give you subsets of the total functionality for a fraction of the cost. And then, if you want to, you can slowly acquire the complete system.

Primavera Project Planner

La Primavera, the famous painting by Botticelli, is a study in luminous grace. The \$2,500 project management package with the same name, from Primavera Systems, doesn't have the visual elegance of the painting, but its graphs can be customized to suit your taste, and its reporting features are especially powerful. The only major drawback to this power is that it takes time and patience to learn and use.

The Gantt chart and the resource histogram in *Primavera* can be configured to paint their graphic representation with any ASCII characters you want. There are nine different codes to adjust for the Gantt chart: early and late starts, positive and negative float, overlap, actual, date line, holiday, and level. If you use graphic characters, you get solid, bright red bars for critical activities, blue ones for noncritical tasks. Data will appear in shaded, matte versions of the red and blue bars, and squiggly, vertical shaded lines symbolize activities that are delayed or late. The positive and negative float are best indicated by using the Plus and Minus Sign keys. The graphic symbols used for the resource configuration can also be set up as you wish.



FACT FILE



Primavera Project Planner
Primavera Systems Inc.
2 Bala Plaza
Bala Cynwyd, PA 19004
(215) 667-8600
List Price: \$2,500;
Primavision, \$1,500.

Requires: 512K RAM; hard disk drive,
DOS 2.0 or later.

In Short: *Primavera Project Planner* has some of the most thorough coding and reporting facilities in any project management program. The program takes a lot of time and effort to learn, and there is some weakness in the on-screen graphics, particularly if you don't also buy the optional graphics package. Not copy protected.

Circle 1 on Reader Service Card

But here there are ten symbols to establish—two that apply specifically to resources are “actual” and “maximum.”

While the Gantt chart has some good qualities—chief among them the ability to be customized—it falls short in some important respects. On the bright side, you get to see up to 20 activities at a time, with their IDs and descriptions. If the time scale is in days, 9 weeks of time are visible; if the time scale is in weeks, 11 months are visible. But even when you are in a daily time scale it is difficult to judge accurately the duration of activities from the length of the bar used to represent it. In the weekly time scale, this problem is worse, and in the monthly time scale, 17 days and 1 day look exactly the same. You can't see milestones on the chart, even in the daily time scale, because an activity of one day and a milestone with no duration are both represented by a single slash mark. (In the printed version of the time scale, using the graphics package *Primavision*, which sells separately, milestones are represented by diamond shapes to distinguish them from other activities. *Primavision* costs an extra \$1,500.)

The only other problem with the Gantt isn't a graphics issue, it's a matter of how finely you can set the duration of a task. One day is the smallest denomination. Many tasks in a project might take less than a day or some number of days plus a

COST ACCOUNT DICTIONARY

BASE

COST CATEGORIES (6 CATEGORIES MAXIMUM) :

Code	Category Title	Code	Category Title
E	EQUIPMENT	L	LABOR
M	MATERIAL		

COST ACCOUNT TITLES:

Cost Account Number	Account Title
318	CONSTRUCTION DEVELOPMENT COSTS
311	ENGINEERING DEVELOPMENT COSTS
312	PURCHASING DEVELOPMENT COSTS
313	PROGRAMMING DEVELOPMENT COSTS
328	CONSTRUCTION OPERATING COSTS
321	ENGINEERING OPERATING COSTS
322	PURCHASING OPERATING COSTS

Commands: **ESC** Help More Print Return Transfer

Primavera Project Planner's Cost Accounts Dictionary shows both the cost categories and the cost accounts. Features include summary and detail accounts for tracking the cost of a project.

fraction. But with *Primavera* you are forced to estimate.

Primavera omits the network diagram altogether; with *Primavision* you can produce a printed network diagram. The company says that this summer it will release an updated version of the graphics package that will include screen support for network diagrams. The company says the new version will let users add text, draw lines on the diagram and scroll through it.

TOP-NOTCH REPORTER Obviously, unless you purchase the graphics package for the hefty additional fee, graphics are not the centerpiece of this program. Its real power is in the reporting features and the ability to control them to an exceptionally detailed degree. Be forewarned, however: it will take time and careful preparation to use this power to the fullest.

The key to all of *Primavera's* reporting is its coding facilities. Each activity can be assigned up to 20 codes. This allows you to put activities into categories such as responsibility, location, department, project phase, and so on. When you want to view the project either on the screen or in printed reports, you can sort on any or several of

the codes at once to create truly customized reports that are tremendously deep or highly specialized.

Although it isn't mandatory to define codes in the Activity Codes Dictionary, it does help you to use them consistently, and it's the only way to have them appear on printed reports. In the dictionary you give the codes names, set their field length, and give them descriptions. The program comes with three codes built in: RESP for responsibility, AREA for area or department, and MILE for milestone. Once the codes have been established, you can enter the actual code values on a title page. Thus, if one of the codes is going to be used for DEPT, or department designations, the title page might list CON for construction, ENG for engineering, PCH for purchasing, and so on.

In addition to the 20 activity codes, you can assign four activity IDs. These ID codes might apply to a work breakdown structure, giving you still another way to fine-tune your reporting.

Primavera has two other dictionaries as well, a Resources Dictionary and a Cost Accounts Dictionary. The Resources Dictionary lets you define resources before al-

■ PROJECT MANAGEMENT SOFTWARE

locating them to activities. Besides naming each resource, you get to indicate the normal limit and maximum limits of availability—and you get to do this for six time periods. This kind of detail isn't found in other project management programs. Along with the six availability periods, you can set six price or unit costs for particular periods of time.

The Cost Accounts Dictionary lets you institute summary and detail accounts for tracking the costs of a project. To start with you can designate six cost categories, such as equipment, labor, or material—each with single character identifiers. Then you can set up as many individual account numbers as you want. These numbers can be assigned so that each digit represents another account category, such as project, type of cost (i.e., development or operating), and a department. Numbering this way enables you to summarize costs later by any of those account categories.

Establishing the codes and entering them can take a lot of time, but it's well worth it. This becomes obvious when you start using the autosort and viewing capabilities of the program. You can sort data by four successive levels, so those activities that make it through the first sort filter will then be sorted by the next set of criteria, and then the next, until all four levels have been sorted. The sort parameters can be any of the activity codes, or the duration, early start date, total float, predecessor, and so on.

You can tighten the sort net by using Boolean connectors, such as "equal to" (EQ), "not equal to" (NE), "greater than" (GT), and "within range" (WR). Then on another screen, called the Order Window, you can set the order in which the sorted activities should be presented. Within each level you can use seven selection criteria. You can also indicate if the selection should be made on the basis of all the conditions being met or just any one of them.

Once the sorting is done you can view the data either on the screen or in printed reports. Results can be presented on the screen in a table or in a Gantt chart; if you've sorted by resources and costs, your graphics choice is a histogram or cumulative curve chart.

In addition to the on-the-fly reporting

you can do by just sorting and viewing data, there are 14 standard reports in the program. They include a schedule report, resource profile, cost profile, earned-value report, cash-flow report, and resource-loading report. You can go beyond these 14 reports by working with seven more preformatted reports designed for customizing. The preformatted types include resource reports, cost reports, schedule reports, and so on. Within the resource reports area there are seven more reports, and each of them can be tailored to precise specifications.


One of the best uses for reports is to compare actual data to target data. *Primavera* allows for two active target schedules at one time. *Primavera* also allows you to export data to other programs directly, in the file formats they require. The file types it handles are .WKS, .DBF, and .PRN.


Still another outstanding feature of this program is its automatic resource leveling. Here again the system can be bent to your will. *Primavera* is programmed to level the activity with the least float time first. If you want to override this routine you can do so by using priority codes—you're allowed up to ten. These would be defined in the Activity Codes Dictionary, perhaps under a name like *PRIOR*. Once leveling has been done, the program presents the Resource Leveling Analysis Report detailing the impact. One very nice element in the report is the indication of slip-page—that is, the difference in the amount of float time before and after leveling.

If detailed, customized reporting is the most important element to you in project management—and you can afford to pay for it—then consider *Primavera Project Planner*.

Project Scheduler Network

Project Scheduler Network, \$575 from Scitor Corp., has some of the best graphics available in a project management package. The Gantt chart has a crisp, modern look and is very easy to read; the PERT chart is also clear and can be displayed in several sizes. The histograms and cost curves are quite good. Unfortunately, the rest of the program doesn't live up to the

**FACT FILE**



Project Scheduler Network
Scitor Corp.
250 Lincoln Centre Dr.
Foster City, CA 94404
(415) 570-7700
List Price: \$575
Requires: 320K RAM, graphics card, DOS 2.0 or later.

In Short: *Project Scheduler Network* has excellent graphics capabilities. The charts and graphs are all neat and modern-looking, and they provide good informational depth. But the program has no on-screen help and falls down in sorting and some parts of its reporting features. Not copy protected.

CIRCLE 564 ON READER SERVICE CARD

graphics—the interface is somewhat inconsistent, and the reporting features are only average.

The PERT chart is in some ways the core of the program. It is here that task relationships are established. The PERT chart is also the default screen, appearing every time you've completed a program operation. If you haven't yet set task relationships, this screen will be blank, except for a single line of command menus across the top. Before you can produce the PERT chart you have to enter activities on the Job Data Entry screen. Then, moving back to the blank PERT screen, you access a pull-down list of the activities by using the *JOB NAMES* command. One by one, you mark the activities and place them on the PERT screen by positioning the pointer and clicking the left button of the mouse. The activities appear as boxes with important activity data displayed inside.

BOUNTIFUL BOXES When all the activities have been placed on the screen, you still have nothing more than a series of boxes—although they may be lined up from left to right in roughly the order they will occur during the project. Linking the boxes together to make the PERT chart into a true network diagram is very simple. First you place the mouse pointer in the box of a successor task and click. Then you move the pointer to a predecessor task. As you do, you drag a line across the



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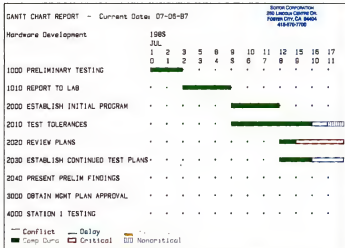
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Project Scheduler Network's Gantt chart is thoughtfully designed. Completed tasks appear as solid green bars and incomplete tasks are outlined bars, white for normal and red for critical. Hatched bar areas indicate slack time in the project.

screen from the first box to the second. With the pointer in the predecessor box, you click the mouse again and the link is complete. There is even an arrow at the end of the connecting line indicating the direction of the task flow.

The boxes in the PERT chart hold a lot of information. The upper left-hand corner has the work breakdown structure code, and the upper right-hand corner has the activity sequence number. The activity name runs across the middle of the box. Under that are the start and finish dates and the duration. One novel information cue is a little green square that moves from left to right along the bottom of the box to reflect how far along the activity is as a percentage of its duration.

Unlike many other project management programs, *Project Scheduler Network* lets you see a fair number of activity boxes at once on the screen. There are seven levels of magnification. The default size, 4 boxes by 4 boxes, displays the fewest task boxes—anywhere from three to seven at once—but reveals the most information about the task. The next size, 6 by 6, eliminates all the data except for the task's sequence number, but now you can see up to

13 boxes at once. The most telescoped size is 32 by 32. In this view of the PERT chart, the boxes are the barest of outlines with no numbers, but the critical path is still indicated in red connecting lines. There is also a Position option on the zoom menu that acts as a toggle switch from one position in the network to another.

THOUGHTFULLY DESIGNED The Gantt chart in *Project Scheduler Network* is as thoughtfully designed as the PERT chart. Completed tasks, or finished portions of a task, appear in solid green bars. The incomplete portions, or future tasks, are outlined bars—red if it's critical, white if it isn't. A hatched bar area indicates the amount of slack; milestones are a single hatch mark. The symbols are so well differentiated that visual comprehension is almost instantaneous. The overall appearance of the Gantt chart is neat and modern. The time scale on top can be adjusted to display in days, weeks, or months. Under the dates are numbers indicating the number of time periods from the beginning of the project, which helps in judging the duration of the task bars. In addition, there are vertical lines running down the chart

that correspond with these time periods.

One of the more interesting graphic images in the program is a split screen showing a Gantt chart across the top and a resource histogram across the bottom. The Gantt chart reflects only those tasks to which the selected resource has been assigned. The histogram shows the total resource use in each time period of the Gantt chart. If you move the mouse pointer into the resource area and click the left button you call up a histogram for the next numbered resource. To move backward one resource you click the right mouse button. In this manner you can move through all the resources for every period of time in the project.

There are other good graphs as well. You can produce summary Gantt charts and several cost curves. One of the most useful cost graphs is a three-line comparative cost curve, depicting current planned costs, baseline planned costs, and actual costs. You can also produce a graph for just labor costs, or labor and other costs, and three others.

The interface to *Project Scheduler Network* is a combination of pull-down menus, mouse pointing, function keys, and keyboard entry. You must use a mouse with the program, but you can use the keyboard as a mouse by choosing it in the DRVINST file and then running the KBMOUSE file before starting up the program. A mouse is an excellent interface tool, but in many situations using function keys is still quicker. To the credit of the program, you can often choose the function keys in place of the mouse for invoking commands.

But the interface is inconsistent. The first evidence of this comes when you have to call up a project file. To do this you go to a File Processing screen. In this screen the mouse means nothing. The pointer has disappeared and all actions are performed by the function key commands listed at the bottom of the screen and by typing file names. You can't point and click on a file directory to call up a project—which would certainly be faster—and you can't click on the commands to activate them. In all, it takes five function key commands and keying in the drive and two filenames before you can access a project. That's a rather long procedure for a simple process.

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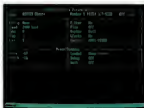
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FREEWAY	YES	YES	YES	YES	YES	YES	NO	NO	75-115.2k	NO	\$ 24.95
FREEWAY Advanced	YES	YES	YES	YES	YES	YES	YES	YES	75-115.2k	YES	\$ 89.95
Xtalk XVI	NO	NO	NO	NO	NO	NO	NO	YES	110-115.2k	WELL	\$195.00
Xtalk Mk.4	YES	NO	NO	YES	YES	YES	YES	YES	300-115.2k	WELL	\$245.00
Smertcom II	NO	NO	YES	LIMITED	LIMITED	NO	NO	NO	110-9600	NO	\$149.00
MS Access	NO	NO	NO	LIMITED	LIMITED	YES	YES	YES	50-9600	NO	\$250.00

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FREEWAY

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■ PROJECT MANAGEMENT SOFTWARE

Other data entry screens have the same problems because they don't let you use the mouse.

Another aspect of the program that is not well implemented is the sorting facilities. While you can sort on some task parameters, such as early start, slack, predecessors, the work breakdown code, name, and duration, you can't sort by critical tasks, milestones, late starts, late finishes, or resources.

CANNED REPORTS The program provides only a few basic canned report types and these can hardly be customized. For example, if you choose the Job Description report, the only control you have is the group of activities you want in the report and whether it should deal with individual activities or an aggregate of the activities. You can't select the information presented in the report or customize its layout.

The one report type that provides some flexibility is the Job Selectable report. It allows you to build an activity report from scratch. There's a job selection screen that lets you choose the kind of activities to report on—critical, complete, milestone, and so on—and the date range—early start, late start, and so on. Then there is a Field Selections screen that lets you select the kind of task information you want displayed, such as WBS code, job name, duration, predecessors, labor resources units and costs, and earned value.

The most amazing slip in the program is the on-screen help. There is none. Today it is hard to find any program without on-screen help, and it is especially important in programs as complex as project managers. While the manual is good and explains all the program operations carefully and thoroughly, illustrating discussions with screen diagrams, this does not make up for the missing help function. In addition there is no on-screen tutorial, although there is a printed tutorial in the manual and special files to use with it.

Project Scheduler Network has placed its bets on the graphic side of project management, and it does this job extremely well. There is a nice variety in the graphs available and they are well designed. If the same effort had gone into its other areas, the program would be an exceptional project manager.

Project:Vision

Project:Vision, \$349 from Inmax International Publishing, is unique on the lower end of the medium-priced programs because of its spreadsheet-like approach to creating a project. Activities are placed in boxes in a spreadsheet grid and then connected by relationship lines that cross and curve over columns. The resulting diagram, which serves as the operational terrain of the program, looks very much like the rendering of a pipeline network with pumping stations strewn across it. This and other screens in the program have a primitive feel to them. For one thing, in the age of color, this program is still in black and white only.

The network screen in *Project:Vision* is numbered along the top and lettered down the side, just like the screener in a spreadsheet program. But instead of entering numbers or mathematical formulas in the spreadsheet cells, you enter project activity data. To do this you move the cursor—which is just an empty activity box—to a cell location and place a box there by pressing the F1 key. To get a full view of the fields within the box you can zoom in by using the Plus key. There are five levels of zoom; the highest level displays one activity box on the screen at a time, with all its information revealed. The

lowest zoom level, which can be approached by using the Minus key, lets you see the most tasks at once—perhaps hundreds.

The data you enter into the activity box consists of an ID, estimated duration, a two-line description, the earliest start and finish dates, and the latest start and finish dates. The box is actually split in two vertically, and on the right side is a listing of the resources assigned to that activity. But before resources can be allocated to tasks they have to be entered into the Resource Definition Table. To do this you call up a work-area window with seven columns. On each line you enter one resource. The parameters you work with are the resource ID; a description up to 32 characters long; the limit of availability; the resource type (there are two of these, R for a resource billed on a daily rate and Q for a resource billed as a cumulative quantity); cost; a show field, which indicates if a resource histogram will be displayed on the bar chart and where it will be displayed; and finally a field called print, indicating if a histogram should be printed. The Resource Definition Table can hold 100 resources.

To allocate resources to an activity, you go back to the network diagram, place the cursor over an activity box, and press R. There are four data fields on the resource side of the activity box. You enter the ID, amount, duration (a T indicates that the resource will be available for the full length of the activity), and lag, which is used to indicate how many days from the activity's start date the resource will come into play. The activity box will hold ten resource entries.

KEYS IN MOTION Operations in *Project:Vision* are generally set in motion with function or regular keyboard keys. A full listing and corresponding definitions of these keys is available in an on-screen help window. Help and a number of other basic functions can be reached through a series of pull-down menus activated by pressing the Slash key. The pull-down menu bar has four titles: File, Edit, Do, and Setup and Help. Some of the menu options then have a further window menu that pulls down on top of the first menu. But the pull-down menu approach seems like a bit of cosmetic gloss put on a program that

**FACT FILE**

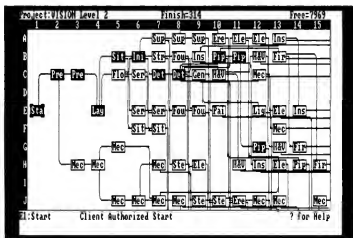


Project:Vision
Inmax International
Publishing Ltd.
200 W. Thomas St.,
#110
Seattle, WA 98119
(206) 285-1588
List Price: \$349

Requires: 256K RAM (\$12K recommended), IBM or Hercules graphics card, DOS 2.0 or later.

In Short: *Project:Vision* is perhaps the most unusual of the medium-range project management programs. You work in the network mode and in a spreadsheet-like format. The program has decent power and fair reporting, but may not be worth the price when more well-rounded programs are available for just \$150 more. Not copy protected.

CIRCLE 66 ON READER SERVICE CARD



In the Project:Vision PERT chart, activities are placed in a spreadsheet grid and connected by lines that cross and curve over columns. The resulting diagram serves as the central operating screen of the program.

■ An interesting extra in *Project:Vision* is a text editor that enables you to keep notes on every activity, and the notes can be as long as you like.

works more down at the command level.

All of the screens in *Project:Vision* have a primitive feel to them. It's as if you're driving a moderately powerful car with fairly good control, but there's no upholstery on the seats, certainly no radio, and no other amenities. This applies to the Gantt chart as well. It is very legible graphically, and you can see the critical and non-critical tasks immediately, but there are no precedent indicators, only the activity IDs show, and there is no other general activity or project data shown.

However, on the plus side there are

three histograms displayed at the bottom of the Gantt screen. You can have two resource histograms for the same time period as the Gantt chart above it and a histogram for the total project cost. If you move the cursor down through the activity IDs on the bar chart, the resource IDs of the histograms will be highlighted if the resource is used in that activity. These display features are very nice, and although the charts are primitive looking they do display useful information. The screen full of charts can be zoomed in and out as a whole.

Project:Vision also offers automatic resource leveling, but the program adopts the philosophy that a resource conflict should not delay the finish date of a project. Therefore, it will readjust only the noncritical activities. Because of this, the leveling routine will not always eliminate all the resource conflicts. If an activity has been rescheduled, there will be a dotted line in front of it showing how long the delay will be. There are some manual ways to resolve these remaining conflicts. One approach, of course, is to increase the availability limit on the troublesome resources. The other is to introduce float on the project deadline, if it's acceptable to delay its finish date.

An interesting extra to the program is a text editor that enables you to keep notes on every activity—and you can make those notes as long as you'd like. The text editor offers find and replace functions, block moves, and line editing.

The reporting features in this program are bare-bones. But, occasionally, as you work your way through a project schedule an unusual feature shines forth, as, for example, in the sorting facilities. There are only five report types, and two of them, Memos and Export, aren't really reports. The other three are Tabular, Summary, and Detail. Into these formats you can pour either activity data or resource data. To give you some customizing features there are a limited number of sorting and selecting options. The one extra in this area allows you to select a secondary sort option that is used as a "tie-breaker." In fact, you can select as many secondary sorts as you want.

While *Project:Vision* has some unique and intriguing approaches to project management, overall the system isn't as powerful, flexible, or visually appealing to use as products that cost only about \$150 more. It's hard, therefore, to justify its purchase unless the difference in money is critical. If so, there are enough features here to use for small to medium-sized projects.

Pro-Path-Plus

Pro-Path-Plus is a very basic project management system. It even has something of a primitive feel to it, partly because of its reliance on command entry and partly because of its simplified Gantt chart. Yet, this program has a fair amount of depth in features.

There is no mistaking *Pro-Path-Plus*, \$495 from SoftCorp, for the kind of program you'd need to use for large projects. A project can have only 500 tasks, with no more than ten dependencies each, and you have to work within the limits of 60 resources—only 8 allowed per task. It's possible to extend these limits by linking projects together or using subprojects, but the program generally has a small-project feel about it.

There are just 19 basic commands for performing functions in *Pro-Path-Plus*.

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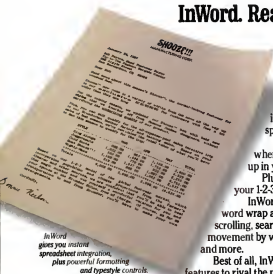
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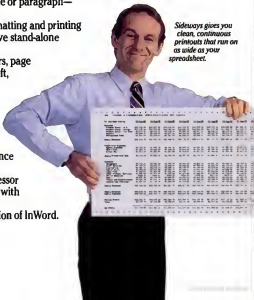
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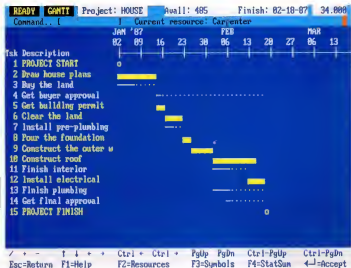
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■ PROJECT MANAGEMENT SOFTWARE



Pro-Path-Plus's Gantt chart uses red bars to portray critical tasks. Noncritical tasks are indicated with black lines, and black dots represent slack time.

These commands, for doing things like adding a task, setting the scale on a histogram, sorting project tasks, saving a baseline project, or displaying a network diagram of the project are all initiated with two letters—so the commands for the above functions would be AD, SC, SO, BA and NE.

Because this program uses a command language of sorts, you can accomplish a

more complete operation than might be possible in a program that relies on a menu approach. For example, if you wanted to move a task in the Gantt chart from one position to another, you could type "MO1 3" and task 1 would be moved into place just after task 3—after the command is verified in a pop-up box. In a menu-driven program you would probably have had to make several menu selections and fill in a form to accomplish the same operation.

Commands are entered in a little command box at the top-right-hand corner of the screen. After every operation, the cursor returns to the first character space in the command box, ready for the next command.

FRIENDLY MOUSE Using commands isn't a comfortable approach for everybody, especially today when people are used to "friendlier" interfaces. *Pro-Path-Plus* takes this into account and offers a mouse option. Although the operations are still command driven, you can approach it with the ease of pointing and clicking. To help you remember the commands, which are not displayed automatically on the screen, you can call up a command panel

by using the Slash key. Then with the mouse you can highlight and employ a command. The only problem with this approach is that in some cases you will have to retreat to the keyboard in order to type in an entry. Going back and forth slows you down.

Like most good project management programs, *Pro-Path-Plus* uses the Gantt chart as the heart of the scheduling process. *Pro-Path-Plus*'s version has the same primitive feeling as the rest of the program. One reason is the time scale. If it is reduced to what would be an hourly measure, there are no crosshatch markings for the hours, so it's very difficult to tell how long a task is meant to take by just looking at the chart.

When the time scale is reduced to days or hours, the task bars can run off the screen on either end. But there is no indication of this at the edges of the Gantt chart. This makes it easy to lose the visual perspective on a task's duration. In the daily time scale you see only seven working days at a time.

The Gantt chart fails in providing no indication of negative slack, and in its approach to numbering tasks. Tasks retain the numbers assigned to them, based on the order of entry. So, if you move tasks around to position them more realistically in the schedule, their numbers are no longer in sequential order. To reorder the numbers you have to invoke the Renumber command—an uncalled-for extra step.

RED ALERT Although the Gantt chart has some weaknesses, there are some nice features as well. The critical tasks are portrayed in red bars that really pop out at you. And to further emphasize the critical nature of these tasks, the task number and name are also written in neon red. The non-critical tasks are displayed in black lines followed by black dots to show slack time. This contrast makes the chart a quick, easy read. Completed tasks appear in soothing blue with a very finely dotted, matte-like finish, as opposed to the glossy red of the critical task bars.

Other useful features include a listing at the top of the chart showing how many of the 500 project tasks are left to be assigned; the finish date, followed immediately by the number of days that the project will



FACT FILE



Pro-Path-Plus
SoftCorp
2340 State Rd. 580,
#244
Clearwater, FL 33575
(813) 799-3984
List Price: \$495
Requires: 384K RAM,
one floppy disk drive, DOS 2.0 or later.

In short: *Pro-Path-Plus* has a rather primitive feel in its interface and project charts. But the program's simple command language speeds up some operations and there are some intriguing features. Not copy protected.

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■ PROJECT MANAGEMENT SOFTWARE

take; and the last resource assigned.

You add tasks to a project by filling in the task form presented at the bottom of the Gantt chart. On this form you enter all of the task particulars: name, code number, duration, lead/lag time, planned start, planned fixed cost, dependencies and resources/quantities (but you can't enter planned finish date).

The PERT chart in *Pro-Path-Plus* suffers from the same limitation as many others: you can't see enough of it at once. But you can see the flow in and out of selected activities, which can be helpful. The program uses color to distinguish critical tasks and completed tasks. Arrows at the ends of flow lines reinforce the directional meaning of the lines. The task boxes list the duration of a task; if a task has been completed, you also get to see the start and finish dates.

There is no zoom feature, so you usually can't see more than three task boxes at a time. But you can, of course, print out a network chart for an entire project. An added convenience is the ability to add, delete, or change a task in the network view.

The calendar function in the program doesn't allow you to specify work hours for individual days, so you can't apply varying work schedules to a project, except in the way you allocate resources. The full use of a resource is indicated by putting in the number 8, if your work day is 8 hours long, rather than 1 as it is in most other programs. Thus you can translate a partial day into a number less than 8 (but not a long day into more than 8), out to three decimal places. The only problem with this approach is that the fractional numbers are applied throughout a task's duration. You can't specify individual partial days. This can throw off the automatic resource leveling routine in the program. You can get around this problem, but you're forced to create phony tasks to do it.

To set holidays and other days off you have to type dates into a columnar form on the calendar definition screen. Unlike nearly every other project management program, *Pro-Path-Plus* doesn't show you an actual calendar.

The program's automatic resource leveling routine is fairly slow. With only nine tasks it took 15 seconds to smooth out a project schedule. If the project had hun-

dreds of tasks, you can guess how long a wait there would be. Another shortcoming in the program is that cost tracking has to be done through the report functions.

Pro-Path-Plus has well-rounded reporting functions. Within the basic report formats you can choose the tasks you want, or the date range, or a particular resource, and so on. When you are printing detailed reports you can select the specific project details you want to include, and the order in which they should appear by putting numbers alongside the detail columns you want.

One intriguing feature of *Pro-Path-Plus* is Statistical Functions. When this is turned on, the program asks you to specify three task durations instead of one: the optimistic, pessimistic, and most likely durations. From these entries the program computes a fourth duration: the length of a task based on a 50-percent probability measure. If you use the Statistical Functions, you can do what-if analysis based on the different durations.

Although *Pro-Path-Plus* has a somewhat primitive feel to it, there is enough facility here for most small projects. If you don't mind using a simple command language, some operations are actually faster than they would be in other, menu-driven programs.

Qwiknet Professional

The "Professional" in *Qwiknet Professional* is no misnomer. This \$1,495 program, from Project Software & Development, is definitely for the professional project manager or the manager who is willing to spend time learning the system. There is quite a bit of precision built into the program, which allows you to fine-tune your project views and reporting. But to take advantage of this precision you have to spend time organizing, entering all the data, and laying out your project.

The time spent in working with the program is increased by the blizzard of forms you have to work through to enter data—especially if you're not using a mouse. Another sign that the program is intended for professionals is the emphasis on textual reports rather than Gantt or PERT charts.

The first indication of how form- and menu-intensive *Qwiknet* is comes right at



FACT FILE



Qwiknet Professional
Project Software &
Development Inc.
20 University Rd.
Cambridge, MA 02138
(617) 661-1444
List Price: \$1,495
Requires: 512K RAM.

hard disk drive, DOS 2.0 or later.

In Short: *Qwiknet Professional* is definitely for the professional. It has very extensive textual reports on projects and very good automatic resource leveling. Its poor graphics, however, will turn some people off. Copy protected.

CIRCLE 661 ON READER SERVICE CARD

the start. You begin a project by going to the project form. While in the main File Directory screen, you press F3 to move the cursor to the command/option line at the bottom of the screen; then you Tab over to highlight the Add Pro option and press Enter. Up pops the form. There are ten fields. Some have default settings (as is typical in most *Qwiknet* forms), some need to be filled in, and some can be ignored, unless you want to engage all of *Qwiknet's* precision characteristics.

You don't have to do more than name the project and indicate a start date. But you could also enter a 48-character description of the project and add a constraint on the project by scrolling through the three choices in the type field—ON (to be finished on a particular day), NET (not earlier than), or NLT (not later than).

The other fields on the form all relate to the automatic resource leveling feature in the program. If you are working with multiple projects, entering a number from 1 to 9,999 in the project priority field tells the program which projects are the most critical when it comes to automatically scheduling resources used in more than one project.

You can choose between two types of leveling. The first, resource-limited, schedules activities only when 100 percent of the resources needed for that activity become available. If the resource isn't available, the program will push tasks back until it is. If it never is, the program will

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PROJECT MANAGEMENT SOFTWARE

The Qwiknet Professional sort/select form lets you sort the project's tasks in up to 40 different ways to create customized activity reports.

schedule the task according to the earliest start date and print a message warning that the resource is unavailable. The second method, time-limited leveling, considers both time and resource availability when smoothing out resource use. It chooses the most-efficient start date between the earliest and latest possible start dates, given the availability of the resource.

AUTOSCHEDULING The other automatic scheduling feature in *Qwiknet Professional* is the CPM method. It heeds the priority settings entered in the activity form. The CPM scheduling feature can be turned off. This is important because if you're editing a large project and making many activity changes, it would slow the process down considerably to let the program recalculate after each change—as it would if it were unaltered. With the recal feature turned off, you can wait until all the changes have been made, and walk away while it crunches the schedule.

The interface of *Qwiknet Professional* makes the program much easier than you'd expect. First of all, you can use a mouse, which makes invoking commands, picking menu options, and even filling out

forms much quicker. You can use the mouse to scroll through fields that offer a choice and to capture words from one part of the program to be deposited in a field.

The other very nice interface feature is the ability to open multiple windows on the screen. If you are working with the resource table and suddenly decide you want to add an activity, you can lay the activity form right on top of what you were doing and enter the data. When you're done, the program returns you to the window you left. You can lay one window on top of another without limit, but after a while the number of windows would begin to slow down the operational speed.

Two of the more dynamic features of this program are its sorting and selecting abilities. They are the key to taking deep and precise views of a project in progress. You can actually sort the project in something like 40 different ways and use this in combination with the selection choices and the 25 canned report forms. To make the sorting and selection features even more powerful, you can assign codes to the activities and resources. There are two code fields in the activity form. By using them you can organize activities into multiple

layers, revealing their position in different phases of a project.

The Gantt, or bar chart as it is called in this program, is not up to the level of the rest of the program. Even its printed version is poor unless you get the add-on graphics package the company is expected to have released in August. Many people find the printed charts of a project the most important output a project management program produces. For them, this graphic failing would be serious. The chart has a background grid of dots that are meant to represent the column and row intersections for activities and time scale gradations. But this polka-dot background is rather distracting because it tends to overload the visual field.

The time scale on the top is also distracting because the initials for days of the week are all squeezed together, making it hard to read. The bar chart symbols are also limited and unappealing. When you get into comparative analysis of activities and projects on the same bar chart, the use of X's, N's and H's, down-turned arrows, and little boxes, makes it very confusing to read.

PERT LESS FUNCTIONAL The PERT chart in *Qwiknet Professional* is less functional than the Gantt chart. You can look at the dependency relationships of a task in the PERT chart format, but this is only a local view and it provides no other information. You can print out a full-scale project PERT chart, but there's no graphic improvement unless you have the new add-on package.

When you create a new project in *Qwiknet Professional*, you can designate it as a target schedule. Then you can compare the actual schedule against it as the project moves along. You can also have a second target schedule that you might create in the middle of a project to refine your comparisons for the later phases.

The program does not allow for the import or export of files in anything but ASCII format. Importing in particular is difficult because the program expects to see data in a certain order. Trying to use files from *Qwiknet Professional* in 1-2-3 or dBASE, or vice versa, is therefore very awkward.

If you are a professional project manager,

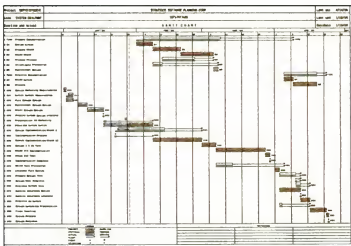
■ PROJECT MANAGEMENT SOFTWARE

er who is most comfortable with a textual approach to recording and monitoring projects, *Qwiknet Professional* is a good program for you. If graphics are important to you then you'll have to evaluate the new graphics add-on package before making a decision (it was unavailable at the time of this review).

SSP's Promis

SSP's Promis is a program with top-drawer functionality and bottom-drawer graphics. It has almost every function a good project management package ought to have: resource leveling, overtime pay for resources, and thoroughgoing reporting with sorting and selecting options. On the other hand, its on-screen Gantt and PERT charts are rather poor, there is no resource histogram or on-screen tutorial, and the manual is dense.

Promis, \$2,995, is a form-based program. Creating a project and entering activities, resources, and costs are all done in forms. This isn't particularly different from most project management programs, except in the degree to which *Promis* is dedicated to this approach, and the fact that there's no graphic backdrop to the process. Most project management programs keep a Gantt or PERT chart in view as



The *Promis* Gantt chart shows the design of a large project with several overlapping tasks. Like most other high-powered programs, SSP's *Promis* has the capability to differentiate graphically between critical, noncritical, completed, and incomplete tasks.

tasks and resources are entered. But not *Promis*.

In fact, getting to a Gantt or PERT chart is no easy matter. You have to enter and process a fair amount of information before you can even attempt it. Activities and their dependencies need to be entered. Then you have to run a logic validation routine to make sure all the activity durations and links have been entered and that there's no loop in the dependencies. And then you need to run the network analysis, which determines the critical path and float. When all of that is done you can produce a Gantt chart from the master menu with three menu selections that drop you through operational levels until you reach the Gantt chart menu screen. Then you have to set device options through another menu selection, move back up to the Gantt menu again, choose the Printout option, set the printout parameters . . . and then, finally, you get a Gantt chart. What commonly takes one keystroke combination to accomplish in other programs takes *Promis* at least eight steps to achieve.

Other operations or data entry procedures also take longer in *Promis* because of the nested layer of menu selections and forms—it simply takes too many key-

strokes to get places. In its favor, the screen responses are quick.

Using forms the way *Promis* does has some advantages. It is easy to get around and perform operations. You might hesitate once or twice when moving through the menus to find the function you want, but then it's easy enough to jump around to find it. The forms also give the program a very ordered feel.

CLEAN SCREENS Strategic Software Planning Corp. has designed the forms and screens so they have a clean look and provide excellent information. Take the Enter Activities screen as an example: in the upper left-hand corner is the project ID and its code name; in the upper right-hand corner is the last access date and the date of the last update. In a bar above the main entry box, you get to see the total number of activities in the project and the ID of the previous activity you worked on. Alongside that, in a little box, is the name of the editing option you're currently using, such as Add/Mod. Below that box is a panel listing the keys that control cursor movement, as well as the help, accept, and abort commands. Undereath the entry box is a listing of function key commands for four



FACT FILE



SSP's Promis
Strategic Software
Planning Corp.
245 First St.
Cambridge, MA 02142
(617) 577-8800

List Price: \$2,995

Requires: 512K RAM

(third disk with 2.5 Mbytes of available space is recommended); IBM XT, AT, or compatible; DOS 2.0 or later

In Short: *Promis* is an outstanding tool for building a project schedule and reporting on project performance. It's easy to use, although you often have to jump through several menus and forms to accomplish anything. Its biggest problem is the poor quality of the on-screen graphics. Copy protected; uses a hardware protection key that plugs into the printer port without otherwise interfering with your printer.

Circle 663 on Reader Service Card

PROJECT MANAGERS: WHAT TO LOOK FOR WHEN YOU BUY

Before you rush out to buy a project management package, you should sit down and think about the kind of projects you will use it on and who will be using it. This analysis of your needs is a critical first step because of the wide variety in available programs and their vast differences in price. There is no one ideal project management program. If you have a clear idea of what you need, then narrowing the field of consideration will be easier.

The following guidelines for this analysis process come from Daniel Yahdavi, president of I Soft Decisions in Mill Valley, California. Yahdavi has worked in the project management field for 15 years. For the last several years his company has done nothing but evaluate personal computer project management programs. The annual report I Soft releases on these products costs \$395.

Yahdavi's hints:

Capacity Think about how many tasks your typical projects run—are there usually only a few hundred, or are there thousands? Some project management packages can handle only 200 activities before you have to start using subprojects to get around the limits. Other programs are virtually unlimited and can accommodate as many tasks as your disk space will allow.

Some programs will let you assign as many resources to a project or individual task as you want; others limit the numbers of resources. On the low end, some

programs will allow barely more than two dozen resources in total for a project and only a few per task.

Time scale Many programs will not let you schedule a task duration of less than a day. But some programs will let you schedule to the second. "In industries like construction a day time scale is sufficient," says Yahdavi, "but in other industries and businesses the ability to schedule in hours, and sometimes minutes, can be important."

Resource Leveling Unless you are working on very small projects, the program you choose should have automatic resource leveling—that is, the program will readjust your project schedule for you to eliminate conflicts in resource allocation. "However, the program you pick should allow you to level resource use manually as well," points out Yahdavi. "Automatic routines can sometimes produce inconvenient or illogical schedules that will have to be adjusted manually." The more powerful programs allow you to level resources by availability or by the time constraints on tasks.

Costing When it comes to costing there is a wide range in ability, although none of the project management programs does a fantastic job in this area. Look to see if the program will calculate earned value and do a cost-distribution or cash-flow analysis. "The programs with the more primitive cost facilities allow you to affix only a flat cost figure to a task," says Yahdavi. "If cost tracking is impor-

tant to you, you'll want a program that accrues costs from the usage of resources." The better programs allow you to do both.

Tracking For some people, planning is the end goal of project management. For them the monitoring capabilities of the program aren't critical. But if you want to track a project's progress, then you should look for other features as well. "The most basic consideration is the tracking of time," says Yahdavi. "You'll want a program that lets you report on progress with actual dates." The better programs will also let you report by percentage of work done and will revise the remaining task duration figures.

Comparing Schedules You should have the ability to save one baseline or target schedule for comparison purposes. Some of the more powerful programs let you have two active target schedules at once—an original and a revised target, based on the work complete at that time. "Having two target schedules lets you see your long-term and short-term progress in actuals against plan," Yahdavi explains. Being able to compare the target to actual schedules on a Gantt chart and histograms is added plus.

Reporting "Reporting is one of the most important issues in a project management program," says Yahdavi. "It is also one of the best ways to judge a program and to decide if the package will or will not do the job." You have to examine the printed output and the screen out-

editing functions and four other related forms (that is, resource requirements and costs). All of this is peripheral to the act of entering project activities, but it is extremely useful in keeping your bearings. If you're using a color monitor, the screen is painted a deep blue and the characters and lines are white. It is very easy on the eyes.

Entering information into the activities form proceeds in two steps. First you are prompted to enter an activity ID at the top

of the main entry box. If this doesn't duplicate an existing ID, the rest of the box will fill in with data entry fields and a listing of time constraint options. Then you are prompted for an activity description of up to 30 characters, duration, a workweek code (such as 5d, for a five-day workweek), up to three auxiliary codes, a planned start or finish date, and, if you want, one of seven time constraints used in calculating the critical path and float time.

ENTERING RESOURCES Entering resources and costs is similar to entering activity data. As you're filling in project data you can call up a number of reports designed to tell you the status of data entry. For example, on the Process Network menu there are two such report selections: Review Network Schedule and Review Project Data Input Status. These reports help you to see what information you've already entered and what's missing.

put. First look at the standard reports and find out how many of them you can see on the screen. Then see how much customizing you can do to the reports. The better the program, the richer the sorting and selecting facilities will be.

The most powerful programs will have standard reports with very flexible customizing features and let you set several sorting and selecting criteria at once. These programs will let you design your own reports, from the data to the layout—right down to the field size.

A big part of reporting is graphic in nature. In this area quality is very much a matter of personal taste. But you should consider how clear the charts appear just at a glance—are they easy to read, or do you have to strain to understand all the symbols? In the Gantt chart, how many tasks can you see at once, can you see negative float, how much other information about tasks is shown? The more flexible packages will let you use any ASCII graphic characters you want to represent the different attributes of a task, such as criticality, float, and so on.

Interface The last area to consider when buying a project management package is the human interface. Here again, the issues are partly subjective. "But," suggests Yahdav, "you should look for a program with a well-designed color mix on the screens, or one that lets you change the colors." Then you should look at the mechanics of the operation. Does the program require the use of a

command language—how hard is it to learn? Does the program let you use a mouse, does it have pull-down menus, does it have a windowing capability, and how many forms do you have to wade through to do the data entry? If a project management program is going to be used by all kinds of people, then the friendlier the interface the better.

"Other things to look for," notes Yahdav, "are on-screen tutorials, easy-to-use manuals with thorough indexing, on-screen help (good context-sensitive help is the best), how the program handles input errors, and how it protects data against hardware failure." Consider your connectivity needs and see what kind of importing and exporting facilities the program has.

Once you've determined your needs and looked at program specs, the best thing you can do is play with the programs you're interested in. Some manufacturers offer inexpensive evaluation copies with full documentation for about \$35. "But beware of free demo disks," warns Yahdav. "Most of them are self-running. Since you can't get your hands on the controls, you see only what the manufacturer wants you to see."

Choosing a project management program is a tricky business because the range in abilities and price is so wide. But if you make the effort up front to decide what your basic needs are, you'll be in a much better position to make the right decision.—Henry Fersko-Weiss

The status reports are only the beginning of *Promis*'s reporting capabilities. The program is chock full of reports. There are some 47 in all and most are available on the screen as well as in print form. The reports show you a project from quite an assortment of angles. For example, there are three earned-value reports, three cash-flow reports, a dozen resource reports, summary reports, detail reports, and graphic reports.

In addition, you can use sorting and selecting facilities to refine most reports further. For example, when it comes to activities, you can sort on any of nine criteria—including early start, total float, auxiliary codes—or all nine concurrently, numbered to indicate the order of the sorting. For each of the criteria you can select a from-to range. Because of its depth and flexibility, reporting is the most outstanding feature of *Promis*. It makes monitoring

a project a much simpler process.

Some people like to use printed reports to follow a project's progress and to test alternate scenarios. But for other people, the on-screen graphic views of a project are most important. If you prefer the on-screen approach, *Promis* will be a big disappointment. The three charts available—Gantt, Network, and Time-Scaled Network—have a much more primitive look than the menu and form screens in the rest of the program. The characters are at least a third again larger than the characters in the rest of the program, so their pixels are glaringly clear, even on an EGA monitor. On top of that, the use of color is different and harder on the eyes. You can see the charts in black and white (which tends to be sharper) or color. In the color mode the characters are fatter still and are painted in that neon green or red associated with the green or amber monochrome monitors of days long past. These graphic screens have a definite throwback appearance.

The Gantt chart has further problems. The time scale can only be broken down by weeks, months, or years. This is irksome when resources can be assigned by units as fine as seconds. If you draw the chart to fit the defaults—which gets all the activities on the screen at once—the size of the bars can become so small that they are hard to read or distinguish from each other. In a project with only 30 tasks this is already a big problem. Also, in this form of the Gantt you don't get to see any activity IDs or descriptions, which makes the chart fairly useless unless you like staring at blank bar patterns. There is a zoom function that allows you to enlarge the Gantt chart. Each use of the zoom halves the number of activities shown and proportionately increases the size of the bars. Only when you get down to about six or seven activities on the screen do you get task IDs on the left of the screen and descriptions following the bars in the chart area. But by then the chart has lost its impact because the activity view is so limited, the time-scale period is very short, and the descriptions in the chart are distracting. There are other approaches to generating the Gantt chart, but they either limit the view too much or clutter the chart to the point of being indecipherable.

The Network chart is also in regressive

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green and red with a black background. The task boxes can have so much information in them that you end up with only one box per screen and, therefore, no chart at all. You can restrict the information to just the activity IDs, which improves matters by letting you see six, eight, maybe even ten boxes at once. But this is still a small number and you have to have a printed list of the descriptions to make sense of the IDs. The Time-Scaled Network chart is also problematic. The printouts and, of course, the plots of the graphics are much sharper and clearer, so if you like the graphic views of a project, you'll probably want to use the printed charts more than the on-screen ones. But given this drawback, the reporting facilities in this program are almost unparalleled.

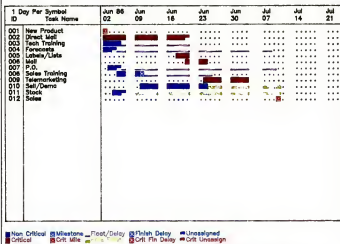
SuperProject Plus

SuperProject Plus is an extremely good program with enough capability to make it at any level of project management. But, recognizing that not every user will want to start right in using all this functionality, Computer Associates has let the user determine the level at which the product will operate—beginner, intermediate, and expert. Plus you can customize any one of these levels. The one weakness in the program is its reporting facilities. (But see the editor's note at the end of this review.)

The program costs \$495 and comes set for the beginner mode, which lets you do very basic project planning and schedul-

"Introduction" Bill, Training & Sales

Project: SALES.PJ
06-02-88



SuperProject Plus's Gantt chart features a background of dots that can be disabled if it seems annoying. Unfortunately, most planning must be completed in the PERT chart and then transferred over, making planning with the Gantt chart rather slow.

ing. The more-powerful features, such as linked projects, automatic resource leveling, and some costing options, are unavailable in this mode. Other limitations: recalculation is automatic; you have to confirm to quit or to delete items; you don't get a second, or planned, Gantt chart; it won't show overtime; and you can't enter "must dates" on the PERT chart.

In the expert mode, the other operational extreme, all of the program's multifarious options are at your disposal. The expert and intermediate modes also operate faster when you're making selections from the program menus because you don't have to press the Return key to initiate an operation. As soon as you've made a menu selection and let go of the pull-down key, F9, the operation is done.

You aren't forced to pick one of the mode flavors. Starting out as a beginner or expert, you can go into the Preferences screen and alter it to suit your own style. This screen lets you set most of the basic editing, formatting, and feature options. In all there are 36 choices. The program operates in the same manner regardless of the

mode you're in. It uses pull-down menus hidden under a bar at the top of the screen. However, the program can also be operated by keyboard commands, making it possible to ignore the menus. A command listing is available through on-screen help or in Appendix G of the manual.

The commands are generally combinations of two or three keys prefixed by the Alt, Ctrl, or Shift key. The prefix could be followed by another prefix key and/or a letter, number, or function key. The commands are even more extensive than the menu selections. For example, Alt-K brings up the previous project, Alt-A saves all projects, and neither of these functions can be initiated through a menu selection.

The best approach to using the command keys is to memorize the ones you use often, because they will save you a lot of time. But otherwise, the commands are difficult to remember, and selecting operations from the menus is much easier.

PERT-ORIENTED *SuperProject Plus* is oriented toward the PERT chart. This is the first screen (naturally it's blank) that



FACT FILE

SuperProject Plus
Computer Associates
2195 Fortune Dr.
San Jose, CA 95131
(408) 432-1727
List Price: \$495
Requires: 320K RAM,
two disk drives, DOS 2.0

or later.

In Short: *SuperProject Plus* offers exceptional flexibility—you customize it to fit your level of expertise. A new release addresses many of the problems in the reviewed version. Not copy protected.

CIRCLE 660 ON READER SERVICE CARD

appears after you start up the program. To start entering activities to a project, you call up a task box with the menu selection "Create Task" on the PERT Chart menu, or use the Ctrl-C (or Ctrl-F3) command combo.

In the middle of the screen a small box appears. This box, small as it is, carries a lot of information about a task. It has the task number, its name, the first or primary resource, the duration, and start and end dates. There are default entries for some of these fields, but as soon as you start typing, these fields are erased and overwritten. Task names can be 16 characters long. Task durations can be in hours or days—this program will not allow for durations in minutes.

As you enter tasks you have to link them, or they remain stacked one on top of the other and only the last task is visible on the screen as the top of the stack. You can move the tasks around to make them visible, but linking will automatically spread them out on the screen as it shows how they relate to each other with a line of dots or diamonds. You can link one task to as many others as you need to, and you can also indicate lead and lag time from either the start or finish dates of the linked tasks.

On the PERT chart, critical tasks are linked by red diamonds and noncritical tasks by blue dots. The program doesn't draw diagonal lines, so the connections are made by tracing a series of dots up and down and then graduating them from left to right. This makes for openwork connections that can get confusing when there are several links in and out of one task.

As in most of the other programs, the PERT chart can only show between four and six tasks at once. This makes it very hard to grasp much of the project and limits the PERT's effectiveness. It's a common failing that Computer Associates hasn't helped to overcome. The Gantt chart is a much better view of a project. The symbol differentiation is clear and makes the chart a quick read. Critical tasks are in red, noncritical tasks in blue—plus they are shaded differently. Free float is indicated with yellow arrows following the task bar; green arrows in front of a task indicate a delay in the task.

When you are in the Gantt chart, though, you can't add a task unless you go

to the PERT chart or the Task Detail screen. Then to get back to the Gantt chart you have to know the keyboard command or use the menus—there's no toggle switch. This makes planning in the Gantt chart slower than it should be. In both the PERT and Gantt charts you can expand or contract the views. The PERT chart has four view sizes. If you are in the broadest view—which will show even a large project in full—the connecting lines become just single dots, so when there are a lot of dependencies it's hard to read and fairly useless. But the next broadest view still gives you a good sense of the whole project—unless it's extremely large—and preserves a better sense of the linkages. Many programs don't do this well.

FLEXIBLE CALENDARS The flexibility of this program when it comes to calendars is truly special. Not only can you set work hours in the project calendar for any time of day, but you can also specify long or short workdays. In addition to the project calendar, every resource has a calendar—so it's easy to be extremely precise with the hours resources that are available. These resource calendars are used by the program when it goes through its automatic resource leveling routines.

SuperProject Plus lets you work with an unlimited number of tasks and resources. There are good subproject and superproject facilities—except that resource leveling will not work across subproject levels.

There are several other missing pieces to this program, unfortunate lapses in what is otherwise an excellent product. There is no resource histogram, so you can't get a graphic display of how a resource is being utilized. The only way to know if a resource is being overused is if the task ID number is flashing. Then you have to figure out if it's the resource that is causing the blinking or a task delay. But you can print out a resource utilization report, which will tell you the conflicts. Another problem is the lack of import facilities. You can export files in various program formats—like 1-2-3 and dBase—but you can't import files.

The major drawback to the program is its reports. Of course you can print any screen, but this is a bad approach to report-

ing. There are only three canned report options: a resource summary, task summary, and resource assignment. You can customize these somewhat, but not a great deal. Missing are an earned-value report, a cost-reference report, an exceptions report, and others. But the program is otherwise a very good contender in the project management arena. [A new version of *SuperProject Plus* due out this month corrects several of the shortcomings in the version reviewed here.—Ed.]

Time Line

Time Line is a versatile, powerful program with few failings. It is also relatively easy to learn and use and, at \$495, relatively inexpensive. It's an effective tool for both professionals and newcomers to project management. The program is particularly good at giving you tools to view and analyze a project while it's in progress.

The first clue to how well-rounded this program is comes when you start the on-screen tutorial. There are seven lessons that take you through building a project environment, entering tasks, assigning resources, managing a schedule's progress, and so on. The lessons are well organized and illustrate the major features of the program. In addition, there is a "fast track" lesson designed for people already familiar with project management. That lesson reviews *Time Line's* features in one 30-minute sweep through the program.



EDITOR'S CHOICE

FACT FILE



Time Line
Breakthrough Software
505-B San Marin Dr.
Novato, CA 94945
(415) 898-1919
List Price: \$495; *Time Line* Graphics, \$195.
Requires: 256K, two disk drives, DOS 2.0 or later.

In Short: It would be difficult to find a better cost/performance deal than *Time Line*. The program has very good filtering and sorting features and an information-packed Gantt chart that is also visually appealing. Not copy protected.

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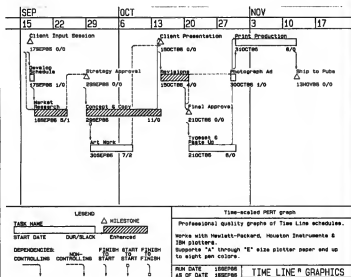
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PROJECT MANAGEMENT SOFTWARE



Time Line's PERT chart is difficult to read because tasks are strung out along a long horizontal axis, making it hard to get a complete picture. In addition, the connecting lines are greatly overshadowed by the boxes, adding to the confusion.

Learning *Time Line* is made easier still by the manual and by on-line, context-sensitive help. The manual is chock full of information—almost too much information. In the margins of the pages are useful "hints," "cautions," and "notes" that make the manual a real learning aid, not just a feature guide. Some of the informational tidbits relate to operations in the program and some relate to the project management process.

But the manual is fairly dense with text and could be improved in places by a few more illustrations of screens. Also, a few of the operations are not explained thoroughly enough. For example, setting multiple dependencies is not explained at all in the manual, although it is quite easy to do. Breakthrough Software is aware of some of these problems and is in the process of redoing the manual.

The on-screen help is particularly good. The explanations are linked to the place you're at in the program, and it will stay on the screen while you finish the operation with which you needed help.

One of the first things you do in *Time*

Line is to set up the calendar. *Time Line* allows you to set any and all hours of the day and night as work time. In fact, you can be extremely precise, setting time calculations to a scale as fine as 1 minute, 5 minutes, 10 minutes, 15 minutes, a half-hour, and an hour. If you use the 1-minute time scale, the calendar can't run for more than 6 months; if you use the 1-hour scale it will run for 20 years.

From the calendar you move right into the Gantt chart. The Gantt chart carries a lot of information and will hold 19 tasks and events at once on the screen. Critical tasks will show on the screen as highlighted bars—but only if you've indicated that the program should show them by using the filter option. If you don't have the chart filtered in this way, critical task bars are indistinguishable from noncritical ones. However, there is a status column just to the left of the date line in the chart where critical tasks are indicated with the letter C.

FILTERING TASKS The filter feature is one of the best tools in the program. With it you can highlight tasks in any number of

ways—by criticality, resources, date range, or special key words in the note section of the task form. Besides highlighting the tasks that fit the filtering criteria, you can hide from view all tasks that don't fit. So, you can temporarily create a Gantt chart with just critical tasks that share a particular resource during a specific date range. This feature is extremely useful when you are analyzing projects to identify potential problems.

You can even select a group of tasks to be filtered and highlighted. Then, you can hide the tasks that don't fit the criteria. You can see these on the Gantt chart or print them out in a report. Filtering allows you to look at tasks that you feel need special attention. It is extremely useful in managing a project.

Filtering tasks leaves them in their proper time sequence on the Gantt chart. But you can also sort tasks, which rearranges their sequence to fit the sort criteria (such as ascending alphabetical order).

The Gantt chart in *Time Line* has more information in it than almost any similar chart in other project management programs. The status column shows partial dependencies and resource conflicts. There is also a resource column (just to the left of the status column) that shows the names of resources assigned to a task. If just initials are used, up to two or three resources will be indicated. If more resources are assigned to a task than can fit in the column, there will be a plus sign to indicate it. The graphic portion of the bar chart shows both negative slack and positive slack. It also shows the fixed tasks that have been rescheduled because of time conflict and the tasks that have begun.

The chart would be even better if there were a graphic way to see completed tasks. But the only way to see this in the Gantt chart is to check the status column. It registers a D if the task is done.

The other major graphic view of a project, the PERT chart, is very difficult to read in *Time Line*. The activity boxes aren't positioned on both a horizontal and vertical axis. Instead, they are strung out across the screen in one long horizontal line. This obscures the visual clues to activity relationships. To make matters worse, the lines drawn from the tops and bottoms of the boxes in a dizzying profu-

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sion have no directional arrows to make reading the PERT chart easier, and the boxes themselves pop out at you so strongly that they detract from the effort to follow the lines.

There are other problems with the PERT chart as well. Only about a half dozen or so activity boxes can appear on the screen at once, forcing you to scroll right and left to keep checking the flow of activi-

■ If its automatic resource leveling feature is turned on, *Time Line* will reschedule tasks on its own to resolve resource conflicts.

ties. And there is no way to zoom the PERT chart or reduce it in size to fit more of it on the screen at once. You can, however, focus attention on one task before you enter the PERT chart, filter out tasks that are not dependent, and then view that in a PERT format. This is perhaps the only useful way to use the PERT chart because the less complicated views that result are much easier to read.

BUILT-IN TICKLER One of the hardest things to do when working with a project management program is to keep everything up to date. You don't get a management edge if the project isn't current. This discipline is harder than it might seem at first. *Time Line* has an excellent tickler feature to help with this problem. It's called the "alarm clock." If you turn it on, and leave it on when you load a project with tasks that need to be updated, the system will beep and display a message at the top of the screen. A typical message might read: "Task 1 should be done now," or "Predict Task 2 late." In the case of the first message there would be a response line under the message, saying, "Should I mark it as done: Edit, Yes, Off, No."

Another nice management feature in

Time Line is one that is becoming more and more common in project management packages: automatic resource leveling. If this feature is turned on, *Time Line* will reschedule tasks on its own to resolve resource conflicts. However, this can take a long time, and it is recommended that you attempt to resolve problems manually before turning the automatic feature loose. *Time Line* alerts you to resource conflicts with an R in the status column of a task. Then if you look at the task form there will be an arrow before the resource or resources that are causing the problem. Then you can look at a resource histogram to explore the problem further.



The reporting features in *Time Line* are fairly standard. There are 12 basic reports, not all of which can be customized. The ones you can customize with filtering or selecting routines give the program some flexibility. Plus you can always select any resource or group of resources for a report. One missing report type that would be very nice to have is a planned versus actual Gantt chart. You can print a comparison report, but it's not graphic.

Time Line is one of the easier project management programs to use. One reason for this is that you're not tied down to any particular approach to building a project. You can jump around from tasks to resource and back as you choose. This makes it one of those rare programs that is easy to learn and use, full featured, and inexpensive. It's a hard combination to beat, so anybody looking to buy a project management program ought to take a good hard look at *Time Line*.

ViewPoint

Few programs combine power and friendliness successfully. *ViewPoint* is one that does. The price paid for this unusual balancing act is loss of speed in calculations and, to some extent, even in the screen responsiveness. This can be bothersome if you are doing a lot of what-if analysis. But if you're willing to put up with some wait time during recalculations, this program gives you an excellent set of project management tools.

ViewPoint uses almost every interface technique possible in its quest for friendliness. There are pull-down menus and pop-



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San Rafael, CA 94903
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List Price \$1,995; \$995
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Requires: 512K RAM, hard disk with at least 2 Mbytes of available space, DOS 2.0 or later.
In Short: *ViewPoint* is an excellent program with no limitations on the size of projects or the amount of resources you can assign to tasks. The reporting features are as flexible as you want if you're willing to learn a mini command language. Not copy protected.
CIRCLE 666 ON READER SERVICE CARD

up forms; you can use a mouse, commands issued by function keys or Alt-key combinations; and there's even a mini programming language you can use to create custom reports and macros. To support this interface richness, Computer Aided Management provides a two-disk, interactive tutorial, a quick reference guide, and a function-key overlay.

The manual is well laid out and indexed, although the pages are somewhat dense with print and the feature discussions can be hard to get into.

INTERFACE SUPPORTS Once you're into the program, there are other supports for the interface. You can seek out on-screen help at any place in the program. The help is context sensitive, so it covers virtually every field or position on the screen but displays just the information you need to figure out what to do next.

In addition to help, there is a message window at the top of the screen that is always visible and instructive. Beneath a title that indicates the function you are performing, there appear two-line notes that tell you what you can do next. For example, when you are in the Network Edit function, the message reads: "Point to edit an activity or add a new one. Connect to create a connection." The messages aren't exactly catchy, but they help you get your bearings when you're feeling a little lost.

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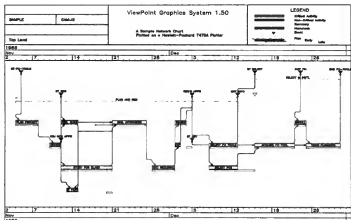
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■ PROJECT MANAGEMENT SOFTWARE



ViewPoint's PERT chart has the unique characteristic of being time-scaled on-screen. Most other programs can accomplish this only in plotter output. The program's Gantt chart is nothing more than the PERT chart with the connecting lines removed.

There are two other windows at the top of the screen. The left-hand-side window displays the name of the project and the network name. At the bottom edge of the box are two mode terms. The term on the left reads either Plan or Track, indicating whether you're in the baseline or actual project schedule. The term on the right reads either Auto or Manual, telling you whether calculations occur immediately after each schedule change or are done manually. The terms not only tell you where you are, but they are used as the switches to get you there—simply by pointing and clicking with the mouse. Other operational terms—like CALC, SAVE, or PENDING—appear at the edge of the center window when appropriate. The right-hand-side window tells you the date at which the cursor is positioned—this changes as you move the cursor over the network diagram below—and the name of the screen you are working in.

The attention given to the interface and design of this program is particularly impressive because the power and depth of features haven't been compromised to do it. To start with, there are no limits on the numbers of activities, total resources, or resources per task; you are limited only by disk space. There are also no limits to the number of holidays or nonworking days

■ One of ViewPoint's most powerful features is that each project maintains its file integrity, but you can apply a common resource library.

you can enter on a calendar, the number of links between activities, or the number of multiple projects you can work with. No other program in the under-\$3,000 price range is so consistently unlimited in its ability to build a project schedule.

You create a project on a time-scaled network screen. At a minimum, each activity gets a name and duration to start with and is then placed on the screen wherever you like, but there is a time scale running across the bottom of the screen to give the network a temporal dimension as well as a structural one. In the beginning you only have to approximate the position of the activity bar in relationship to the time scale.

The activity form you use to detail each task allows you to enter a description, activity code, name and duration, calendar, float, and early and late dates, as well as target start and finish dates. If there is one particular resource that drives this activity and controls its scheduling, you can enter this on the activity form as well.

When you're in the TRACK mode, the activity form has three new fields in place of the target start and finish dates. They are Actual, for the actual start date of the activity; Cmp, for the percentage of the activity's original duration that is complete, and Rem Dur, for the remaining duration. If the start date and one of the other two fields are filled in, the program will calculate the last one.

Resources are entered into a Resource Information table before they are allocated to tasks. Here again, ViewPoint is very complete. In addition to specifying the usual information, the resource name, group code, and description, you can specify that a resource rate is variable and enter the time period and the changed rate. The allocation of resources is made in the Resource Usage subform that pops up onto the screen by clicking on the word "Resources" on the activity form border. The subform overlays the activity form. As you assign the resource, you also get to associate a budget code with it, if you've set up the codes in the Budget Code Information Editor.

MULTIPLE PROJECTS One of the more powerful features of ViewPoint is its multiple project capability. Each project that's grouped together in this process maintains its file integrity, but you can apply a common resource library to all the projects. Then you can automatically level resource use across the projects.

Reporting is one of the most critical functions in a project management package. ViewPoint has a fairly limited number of canned report formats, but they can be expanded through the extensive sorting and selecting facilities. But what really distinguishes this program is the ability to write reports of any format and layout you want through the use of an ASCII word processor and 52 different commands.

It takes time to become familiar with the commands and to learn them well

■ PROJECT MANAGEMENT SOFTWARE



EDITOR'S CHOICE

- Time Line
- ViewPoint

All the programs reviewed here are capable of helping you manage your projects. Which one you choose will depend on how big your projects are, how comfortable you are with project management techniques, and which features you find most important. All of the programs have their pluses and minuses. Two products are particularly appealing, one on the low end of the cost range, Time Line, and one on the high end, ViewPoint.

Time Line (\$495) is a very well-rounded product. The Gantt chart is well done, and you get automatic resource leveling, very flexible reporting features, and the ability to export data in program-specific formats. You can schedule activities right down to the minute, and the program calculates schedules quickly and can handle up to 1,000 activities per project. Time Line is also a very easy program to learn and to use, and it has an excellent on-screen tutorial. For the money, this is a very powerful and flexible program.

ViewPoint is an extremely powerful program that places no limits on the number of activities, resources, or multiple projects you can work with. The program offers an extensive assortment of graphics, using the time-scaled PERT chart as the basic project screen. The report writer—although it requires learning a mini command language—is excellent, giving the user total control over reporting. Yet, with all its power, this program is not difficult to use. ViewPoint's only drawback is that it calculates slowly. While it's expensive (\$1,995), it certainly doesn't top the price charts.

enough to create reports in a reasonable amount of time. Fairly simple dot commands are used to draw formats. For example, to delineate the information fields in the report you would type ".co" followed by the information names: netnames, actname, dur, totfloat, and so on. To indicate the order of appearance on the report, you would issue a sort command like this: ".so netname, actname . . .". Text can be added with the word processor to describe the reports. Once a custom form has been written and debugged, it can be saved and becomes part of the canned report repertoire of the program.

A big part of the reporting abilities of a project manager relates to graphics. The selection of graphics in this program is quite broad, although it is a little eccentric. For example, there is no simple on-screen PERT chart. But there is a time-scaled PERT chart, and this is one that most other programs offer only as plotted output. The Gantt chart is really only the time-scaled PERT without the linkage lines, so instead of listing activity names to the left of the bar chart time frame, the activity names are displayed in the activity bars.

In the Gantt view of a project, you can also show the baseline bars for comparison to the actuals—which is the best way to see quickly how your project is unfolding. Unfortunately you can't sort the activities in the Gantt chart.

The other on-screen graphics include what the program refers to as a network tree. What this amounts to is a structural diagram of the main task divisions in a project. In other words, it can be used to create a work breakdown structure for a project. Alternatively it can be used to diagram the relationship between multiple projects. You can also generate resource histograms.

ViewPoint is one of the most complete and well-rounded project management packages around. Perhaps because of this it is somewhat slow. Other packages gain speed by working mostly in RAM. ViewPoint is too feature-rich to do this. You may have to wait several minutes for a long project to be rescheduled, or for a new project schedule to be loaded into memory. Overall the problem with speed may be a small price to pay for the program's other excellent qualities.

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It's nearly impossible to buy a car, a camera, or a stereo without adding accessories—air-conditioning and alloy wheels, lens hoods and filters, gold-tipped signal cables and dust removers. Ditto for laptop computers.

Sure, the ad for your laptop probably read, "\$2,000—complete!" But once you live with your laptop for a few weeks, you'll find you're going to need a few accessories and a handful of techniques they don't teach in the manual to make on-the-go computing more productive.

Among the many accessories you'll find useful:

- A modem, either from the manufacturer or from less-costly third-party suppliers.
- Extra memory to reach or exceed 640K.
- Hard disk storage. Some laptops can be retrofitted with 10-megabyte hard disk drives.
- A travel case that let you put your laptop PC, your new accessories, and the contents of your briefcase all in one place.
- Alternative energy sources: car battery adapters for most laptops and hefty batteries for the otherwise-AC-only Toshiba T3100.
- Special cables and adapters to plug into hotel and airport waiting-room phones that don't have RJ-11 jacks.
- A small printer.
- 3½-inch disk drives for your desktop PC, or transfer programs to link the 5¼- and 3½-inch worlds.

FOR THE TOSHIBA THAT HAS EVERYTHING

What has a half-dozen 8-bit expansion slots, a power supply, a cooling fan, and a \$1,200 price tag?

Besides "almost every PC compatible on the market," Toshiba's wildly overpriced expansion box for its T1100- and T3100-series laptop portables now joins the list.

The 11.6-pound expansion chassis allows your T1100 Plus, T3100, or the upcoming T1200 and T3100/20 to use expansion cards that give you additional RAM, a network interface, an EGA adapter, or perhaps even a hard disk card. The system comprises a \$999 expansion chassis measuring 6 by 9 by 16 inches, a separate \$199 interface card (required) that plugs into the back of your laptop and temporarily displaces your modem, and a pair of power and signal cables. One of the six slots is dedicated to the signal cable, leaving five slots free.

How does it work? Fine, once you get past the cryptic, occasionally pidgin En-



Toshiba accessories, from the sublime to the ridiculous: a \$99 numeric keypad for the T3100, a \$39 converter to run your T1100 from a car cigarette lighter, a \$999 five-slot expansion box, and a \$199 interface card for any Toshiba laptop. Of course, for that price, you could buy a separate PC. And should.



FACT FILE

Expansion Chassis
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Numeric Keypad
Automobile Power Adapter

Toshiba America Inc.
Information Systems Div.
9740 Irvine Blvd.
Irvine, CA 92718
(714) 380-3000

List Price: Expansion chassis \$999; interface card, \$199 (specify T1100 Plus, T1200, T3100 model); numeric keypad, \$99; automobile power adapter, \$39.

Requires: Toshiba laptop portable PC. Expansion chassis requires interface card.

In Short: The expansion chassis is a stand-alone box that lets you use up to five 8-bit expansion cards with Toshiba laptop portables. You have to yank the internal modem each time you hook up. Worth considering at \$250, but a joke at \$1,198. Better you should buy a desktop PC. The other accessories are fine.

CIRCLE 600 ON READER SERVICE CARD

glish instruction booklets. But the big question is: Will anybody in his right mind buy one? For a \$2,099 machine like the T1100 Plus, buying the chassis makes no sense whatsoever. Instead you should buy a decent PC compatible and stick a 3½-inch microfloppy in the second drive slot. This seems to make more sense because you've got a real keyboard, a screen that doesn't rely on reflected light only, and something that can be used by a colleague when you're off on the road with your portable.

For the \$4,199 AT-compatible T3100, the expansion chassis isn't such an out-and-out stupid idea. But if you need expansion slots on a continuing basis, perhaps you should buy Compaq's Portable III with its \$199 clip-on expansion box that holds two full-length, 8- or 16-bit expansion boards, or the Portable II, which comes equipped with built-in expansion slots.

Two other Toshiba accessories that

make infinitely more sense are the \$39 automobile power adapter for the T1100 Plus and the \$99 15-key numeric keypad for the T3100 and T3100/20. The automobile power adapter does just what its name promises: it lets you run or recharge your T1100 Plus from a car cigarette lighter socket. You may want to get a \$5 Radio Shack Y-adaptor so you can run both your PC and radar detector.

The 7-ounce keypad is useful if you enter reams of numbers. One oddity: the keypad connects on the left side, so most users will have to snake the 20-inch cable under the machine and over to the right side. Toshiba says a 17-key version will be released for the new T1000 and T1200, the ultralight and hard-disk offshoots of the T1100 Plus. Price hasn't been set yet. There is no keypad option for the T1100 Plus.—Bill Howard

Bill Howard is an executive editor of PC Magazine.

CASH AND CARRY: THE BEST BAGS TO BUY FOR YOUR PORTABLE

If you're planning to carry your laptop and all your laptop accessories on the road, plus miscellaneous paperwork, you'll need a carry case roomier than the optional, tightly fitted cases most laptop makers offer.

For workable carry cases, look in luggage stores, mail-order catalogues—just about anywhere but a computer store. What you're looking for is a soft-sided attaché-plus bag, the kind intended for your paperwork on one side and a clean shirt and tie on the other. You'll need inside dimensions of at least 12 by 12 inches (Toshiba T1100 Plus) through 14 by 14 inches (NEC MultiSpeed). The partition should be 2½ to 3½ inches deep. The only computer-company case with adequate room for miscellany is the \$39 case for IBM's PC Convertible.

One of the nicest cases comes from

Land's End, the Wisconsin mail-order purveyor of WASPish button-down clothes. The \$96 Overnight Attaché Case (item 3908420; (800) 356-4444) fits most any laptop in one partition with plenty of room left over in the other for paperwork, pens, calculator, and miscellany. One heavily promoted case to avoid: JS&A's clunky Trade Show Case ((800) 228-5000). Even the larger 12- by 17 by 6-inch JS&A case (\$69.95) won't fit the smallest MS-DOS laptop, and construction quality is a far cry from the "\$200 suggested retail price."

If your tastes run to butter-soft leather, a Scully two-sided attaché that swallows a T3100 with room to spare can be yours for \$350 list. Other stores may have similar styles by different leather-makers for half or twice as much. Or if you're traveling in the Far East, a leather

shop can knock off your canvas or vinyl case in 48 hours.

You may want to place an inch or two of foam padding on the bottom to absorb minor jolts. Nothing much will help survive a 3-foot drop onto concrete.

If you've seen a better case, send us the details (name, price, size inside and out, source, phone number, and a catalog clipping if available). We'll print the specifics the next time we review laptops, and if we use your submission, we'll send you \$50 and a *PC Magazine* T-shirt for your trouble. Send nominations to: Laptop Cases, *PC Magazine*, One Park Avenue, New York, NY 10016. Be sure to include your name, address, phone number, and T-shirt size. One rule only: you or your brother-in-law can't work for the company that makes your favorite case.—Bill Howard

When *PC Magazine* looked at laptops three issues back ("Road Warriors: 11 Laptops Battle It Out," Volume 6 Number 13), three of the go-anywhere machines stood out as Editor's Choices: the Toshiba

- By year's end expect to see still more laptops, most likely including battery-powered 80286-based machines.

T1100 Plus (best all-round performer), Zenith Z-183 Portable PC (best display), and the NEC MultiSpeed (fleetest afoot). A half-dozen others are nipping at the leaders' heels, while power users continue to snap up the \$4,000 AC-only, AT-class Toshiba T3100 and Compaq Portable III.

By year's end, you can expect to see

still more laptops, most likely including battery-powered 80286-based machines (best bet: IBM, still smarting from self-inflicted wounds brought on by the Portable PC and PC Convertible), more laptops with hard disks, and a rush to sell into the void left by market-leader Toshiba after its submarine-propeller debacle.

For those who've already bought, the stories on the next few pages review the accessories that help turn your laptop into a more complete system.

MODEMS Every laptop maker offers an accessory 300/1,200-bps modem, but at \$400, typically, they're overpriced. From third-party sources you can get equivalent modems for less, 2,400-bps modems, combination modem/expanded memory inserts, or miniature external modems that you can use on desktop PCs as well. PC Labs tortured them all on a TAS modem tester that shows which units resist line noise best. We'll also tell you how to get on-line from hotel and airport waiting-lounge phones that lack RJ-11 plugs; if that's still too much of a hassle, take a look

at some of the miniaturized acoustic modems reviewed in *PC Magazine's* modem-review blockbuster (Volume 6 Number 9).

HARD COPY If you're on the road for extended periods, you may want a tiny printer to produce hard copy. Two compa-

- As more laptops come with hard disks and backlit displays, battery life sinks.

nies produce printers roughly the size of a half-height Kleenex box, and IBM and Wang make clip-on printers. Even if you need hard copy, however, you don't need a printer: you can always send a letter to yourself by overnight MCI paper mail, and contributing editor Jim Seymour finds that a warm smile and a polite request will usu-

ally get you the temporary use of someone else's printer (see sidebar "Portable Printers: Why Bother?").

HARD DISKS If the hard disk on your desktop PC has you spoiled, you may want to consider adding one to your laptop. Retrofit kits are available for Toshiba, NEC, and Zenith laptops. At about \$1,000, retrofitting isn't a cheap proposition. Financially, you're probably better off buying a second, hard-disk-equipped laptop PC and passing your old laptop down to someone else in the organization.

To get information on your 3½-inch disks back into your desktop PC, you need either an extra drive on your desktop machine or a transfer program that moves data between laptop and desktop serial ports at floppy disk speed. *Lap-Link* and *The Brooklyn Bridge* are the best of the transfer programs. *PC Magazine* looked at both the transfer programs and add-on 3½-inch drives in "The Technology of Transfer" (Volume 6 Number 13). A third option, adding an external 5¼-inch drive to your laptop, is losing favor as the industry heads toward 3½-inch disks as a standard.

As more laptops come with hard disks and backlit displays, battery life sinks to just 2 to 3 hours. If you're away from AC for longer periods, you may be able to get by with a car battery adapter, which converts your car's 12-volt output down (or up) to the proper voltage. Most makers have them for \$25 to \$40. And enough Toshiba T3100 fans wanted to be able to work anywhere that Adapta-Pak developed a 7-pound portable power supply good for 1 to 1½ hours. You also might look around to see if your public conveyance has 110 volts AC available. Passenger and commuter trains have a handful of outlets (better stick with diesel-powered trains; the voltage surges on all-electric trains could alternately crash and fry your machine in short order). And the bathrooms on airplanes have been put to more bizarre uses. If you're flying first class, if you have an extension cord, and if you're a mega-mile frequent flyer, you could ask the flight attendant to string the power cord back from the galley.

Bill Howard is an executive editor of PC Magazine.

Minimodem for Easy Riders

*Flexible, low-cost
solutions to communicating
on the road.*

Until recently, if you wanted a modem for your laptop computer, you could either buy an internal modem from your laptop's manufacturer or you could carry around a standard, size external modem. At one time I actually did both. Since the fastest internal modem available was an incredibly slow 300-bit-per-second model, I used it when I was on a short trip and didn't have much to send. On long trips I added a 1,200-bps modem to my luggage.

Fortunately, in the past few months several companies have noticed that laptops are becoming popular and have introduced new modems designed specifically for them. The most interesting of these new products are the shirt-pocket-size modems made by Migent and Touchbase. These external modems, not much bigger than a pack of cigarettes, run on 9-volt batteries and offer performance comparable to full-size products.

The shirt-pocket modems have several advantages. You can save \$100 or more by using a shirt-pocket modem instead of an internal—more if you use the shirt-pocket on your laptop and your desktop PC. Since

they can be used with your desktop computer, you're really getting two modems for the price of one. Other advantages include longer battery life on your laptop computer (external modems have their own batteries), the flexibility to use the modem on your new laptop when you upgrade, and—with the Touchbase—an adapter for an acoustic coupler so you can communicate from hotel and pay telephones.

Each of the modems reviewed here has some special advantage that makes it worth comparing to your laptop maker's own product. This advantage could be cost, speed, Hayes compatibility, or EMS memory. Your choice will depend on what other use you may have for your laptop's lone expansion slot, whether you want to use the modem with other computers, and how much you're willing to spend.

Options are still limited—with any given laptop you'll only have two or three internal modems and the externals to choose from. But with the growing popularity of laptop computers, the selection of modems is bound to increase. Here are five reviews of seven modems that will fit your computer now.



Benchmark Tests: 1,200-bps Laptop Modems Tested at 1,200 bps

Signal-to-noise ratio measured in decibels. Longer bars indicate modems that are more noise resistant.

In the modem testing we performed for our May 12 communications issue (Volume 5 Number 9), we saw significant differences in noise immunity between otherwise similar modems. In the laptop modems reviewed in this issue, we see much less variation. The similar performance of all the internal modems tested here can be explained in part by the fact that both Megahertz and Holmes use the same modem chip set from Sierra Microsystems.

The most striking result of this testing is the poor performance of the Megnet Pocket Modem on 3002 lines, especially considering that the Pocket Modem we tested in May performed much better under these conditions. Since we know of no design changes to the Pocket Modem, we attribute this problem to sample-to-sample variations. Remember, however, that our 3002 test line is a worst-case line that's so noisy that you would have a hard time conducting a telephone conversation on it. You're unlikely to encounter lines this bad in everyday modem use. All the modems were competent on normal lines.

The PC Labs modem tests use the TAS VocabCard Channel Simulator and modem tester to measure a modem's immunity to various noise levels and line conditions. The modem tester sends 100 blocks of data, each consisting of 100 bytes, and measures the number of transmission errors. If any errors are detected, the level of noise is reduced and the data sent again. This process is repeated until the 100 blocks can be sent without error.

In all the tests, data is sent between the modem under test and a Hayes Smartmodem 2400 in both originate and answer modes.

The tests are repeated on three sets of line conditions—C4, C2, and 3002—which represent predestined Bell System standards for leased (private) lines. The C4 line is relatively clear. The C2 has some audible noise but not enough to make the connection unreliable. The 3002 line approximates the worst conditions you will normally find on a dial-up line. Each line has higher levels of phase jitter, amplitude jitter, and other line defects than the previous line. The noise introduced for the test is "white noise," which is the hiss normally heard in the background.

Transmission results are given as the signal-to-noise ratio, measured in decibels, which represents the signal level needed to achieve error-free transmission. Each 3 decibels represents a doubling of the ratio, so that at -12 decibels the noise is twice as strong relative to signal as at -15 decibels and four times as strong as at -18 decibels. A modem that is error-free at -6 decibels, for example, is much more noise-resistant than one that is error-free at -12 decibels.

*DNF—Did not finish. Modem was unable to send without error.

Note: The modems intended for the IBM PC Convertible—The Correspondent-IBM and the Easy Talk 3200—could not be tested because our evaluation Convertible had no serial port.

Best-Case Line Conditions

AT&T-Standard C4 Line

Originate Answer

Average-Case Line Conditions

AT&T-Standard C2 Line

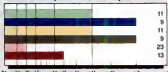
Originate Answer

Worst-Case Line Conditions

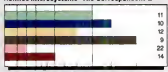
AT&T-Standard 3002 Line

Originate Answer

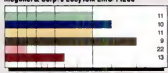
Holmes Microsystems' The Correspondent-T



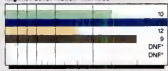
Holmes Microsystems' The Correspondent-Z



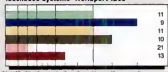
Megahertz Corp.'s EasyTalk EMS/T1200



Megnet Pocket Modem MM1200



Touchbase Systems' Worldport 1200



HOLMES MICROSYSTEMS INC.

The Correspondent-IBM

The Correspondent-T The Correspondent-Z

Holmes Microsystems produces The Correspondent, a series of low-cost internal modems for most of the popular laptop computers. We tested The Correspondent-IBM, -Z, and -T, for the IBM PC Convertible, Zenith Z-181, and Toshiba laptops, respectively; a newly introduced model for the NEC MultiSpeed was not available in time for our tests.

List price for The Correspondent is \$299; that's at least \$100 less than the list price of modems from the laptop manufacturer. The difference in street prices may be not be so great because of heavy discounting of the laptop manufacturers' modems.

The Correspondent modems support the Hayes command set and both the Bell 212 and CCITT V.22 standards for 1,200-bps communications; they are bundled with Softclone's *Mirror II* communications package, which is similar to *Cross-talk XVI*.

All four models use the same manual, with a few pages of specific installation data added for each version of the modem. These few pages aren't always enough, especially if you're putting a modem into the



FACT FILE

The Correspondent-T (for Toshiba T1100 Plus, T1200, and T3100)

The Correspondent-Z (for Zenith Z-181 and Z-183)

The Correspondent-IBM (for IBM PC Convertible)

Holmes Microsystems Inc.
7050 Union Park Center, #610
Midvale, UT 84047
(800) 443-3034

List Price: \$299 (all versions)

In Short: Inexpensive, internal 1,200-bps Hayes-compatible modems for popular laptop computers. All three are good performers. Price includes *Mirror II* communications software.

CIRCLE 847 ON READER SERVICE CARD

TIPS FOR TRAVELLERS: HOT-WIRING HOTEL PHONES

If you plan to keep in touch via modem with the office or use MCI Mail from a hotel, you'll need a travel kit to cope with recalcitrant phone systems.

If your hotel phone has a modular phone jack and plug, you're in business. Unplug your phone and plug in the modem. (Generally, the costlier the hotel, the more likely you'll find modular phone jacks.) If not, you need \$15 worth of phone accessories and a screwdriver in order to deal with just about any hotel phone system in North America.

Here's a shopping list for your accessory kit. The best place for one-stop shopping is Radio Shack or a discount store's phone-parts counter. The advantage of Radio Shack is that every fifth or tenth store has a genius of a 17-year-old future MIT grad working part-time who's delighted to be part of anything that whiffs of contravening FCC phone regs. He'll steer you in the right direction.

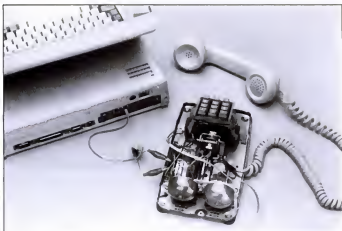
- 12-inch modular-to-spade line cord (Radio Shack part No. 279-391, \$1.20). It's 12 inches of telephone wire with an RJ-11 plug at one end and four loose wires with spade lugs at the other. (RJ-11 is the designation for the modular phone connectors of the past decade.)

- Fully insulated alligator clips (270-378, \$1.29 for 10). Crimp or solder the clips onto the red and green leads of the modular-to-spade line cord. Ignore the yellow and black leads.

- In-line coupler (279-358A, \$2.49). A connector with RJ-11 jacks at each end that makes one long telephone cord out of two shorter cords, so you can put your laptop on the table by the window even though the phone jack is 15 feet away, under the bed.

- Modular duplex jack (279-357, \$4.95). A Y-connector that lets you plug two telephone cords (typically your hotel phone and your modem cord) into the same telephone jack. In a pinch, this can be used as the in-line coupler.

- Extension telephone cord, straight or



No RJ-11 jack in your hotel room? In areas with poor phone signals, bypass the mouthpiece and clip the leads of your homemade RJ-11 adapter cable to the leads of the transformer block. Balance the handset upside down on the hook levers. Looks bizarre, works fine, and it's perfectly safe. (Ignore any odd glances from the maid.)

coiled, with RJ-11 plugs at both ends, \$2-\$10. Coiled cords seldom expand to their claimed length, but they store readily. Be careful not to buy the cord that goes between the phone and the handset (the handset cord) by mistake. It has RJ-11-like plugs that don't fit RJ-11 jacks.

- A small flat-bladed screwdriver or Swiss Army knife for dealing with the innards of the telephone and wall jack.

- An AC extension cord.

If the hotel phone lacks modular jacks, you can access the phone lines in one of five places: the mouthpiece, inside the phone at the transformer block, the wall jack, at a phone-wire junction box along the baseboard, or along the cable.

First, try the easy route: see if the phone has RJ-11 connectors. Sometimes the line cord is hardwired at the phone and has an RJ-11 plug at the wall jack, or vice versa. Also check the bathroom phone, if there is one. Generally you release a wall phone by sliding a locking le-

ver up or down, then ease the phone up and off the wall.

If that doesn't work, the next easiest access is to unscrew the mouthpiece on the handset. The carbon mike pops out and you see a pair of contacts for the microphone. Use your 12-inch cable with the alligator clips. Put the red and green leads on the two contacts. It doesn't matter which lead is connected to which contact. The quality of the modem signal may be affected by going through the phone transformer. If so, attack the inside of the phone.

Remove the phone case and locate the transformer block, which has a maze of multicolored wires attached. Attach the red and green leads of your 12-inch cable to the red and green transformer wires. To keep the telephone hook levers down, balance the handset upside down or use a strong rubber band.

Can't (or don't want to) take the phone apart?



An extra telephone cord, a modular duplex jack (to plug two devices into one outlet), an in-line coupler (to connect two phone cords), an RJ-11-to-spade lug adapter (with alligator clip leads, not shown), a screwdriver, and American ingenuity can keep your PC in touch with the outside world from anywhere in the world.

Then brush aside the dust bunnies most hotels breed under their beds, undo the wall plate, connect your special cable to the red and green leads (you don't need the yellow and black leads), and use the in-line coupler and extension line cord to hook up your computer.

The last method involves minor vandalism to the phone lines and can't be officially endorsed. (The others are just disassembly and reassembly, with no lasting ill effects.) It involves scraping a bit of insulation off the phone cord until you expose the wires inside the red and green leads. Attach your alligator clips and dial away. Contributing editor Jim Seymour has found evidence of this method in airline-club waiting rooms (see the sidebar "New-Age Hobos Hit the Road").

In some cases, you may have to dial manually, then order the modem to pick up in the line (either a special command specific to your software, or by issuing

the Hayes command-set command to seize the line, ATD, then hanging up the phone). You may also have to insert pauses (commas if you have a Hayes-compatible modem) in the dialing string between the 8 or 9 for the outside line and the phone number.

Sometimes even these tactics aren't enough—some hotel phone systems won't let you dial out. Make it a point never to stay there again.

There is the minor point of legality. The FCC expects you to ring up the phone company any time you connect an answering machine, modem, or attack dialer to a phone line, even if you're just passing through town. Don't lose any sleep over the issue. And as long as you keep your hands off the hotel towels and robes, you should be left alone.

—Bill Howard

Bill Howard is an executive editor of PC Magazine.

PC Convertible. It's a difficult operation that involves removing the power supply card, connecting cables, and several other steps.

The main manual is well laid out with both user and programmer information, including descriptions of all the Hayes commands supported by the Correspondents.

All the Correspondents turned in respectable performances on the TAS modem tester, and we didn't discover any Hayes incompatibilities.

The Holmes modems are recommended to anyone who wants to save a few bucks on an internal modem for a laptop computer.

MEGAHERTZ CORP.

EasyTalk EMS/T1200

Megahertz Corp. is the prototypical small, fast niche-marketing company. Whenever the giants create a window of opportunity, Megahertz jumps in. If ATs can run faster by changing a crystal, Megahertz sells crystals. If IBM blows it and makes the modem for the Convertible accept commands in Swahili instead of the Hayes AT command set then Megahertz sells a Hayes-compatible model.

Sometimes I think the development process at Megahertz goes something like this:

"Ya know, the hard disk in the Toshiba T3100 is real slow."

"And I can't run my really big 1-2-3 spreadsheet since it has no extended memory."

"And the modem's back-ordered."

"Why don't we make a combination



FACT FILE

EasyTalk EMS/T1200

Megahertz Corp.
2681 Parley's Way, #2-102
Salt Lake City, UT 84109
(801) 485-3857

List Price: \$189

In Short: A 1-Mbyte expanded memory (LIM/EMS) and modem card for the Toshiba T3100. A good way to cram two functions into a single slot, but the price is high.

Circle 645 ON READER SERVICE CARD

Racal-Vadic Defines Dazzling Performance.

"If there's one
modem that really
stands out in this
crowd of clones,
the 2400VP is it!"

—PC Magazine



Someone finally shed some light on what a real modem ought to be.

After benchmarking eighty-seven 1200 and 2400 bps modems, PC Magazine didn't call our 2400VP just another modem.

They called it Editor's Choice.

Of course, we were grateful. But not surprised.

At Racal-Vadic we've been producing some of the industry's most feature-rich, cost-

effective, "tough-as-a-brick" modems for over 17 years.

For us, the 2400VP is business as usual—a shining example of what price/performance is all about.

PC Magazine agreed: *"The 2400VP brings a number of features formerly found only on very expensive mainframe modems to the PC community at a very competitive price."*

Features like MNP® error correction. A fifteen-number dialing directory. Log-on com-

mands of up to 120 characters.

Add to that the full ATPlus™ command set, automatic data/voice switching, and automatic speed conversion; and it's easy to see why this modem outshines everything in its class.

So if you're ready for more than just another modem, you're ready for the 2400VP.

For more information—and a copy of the 2400VP's brilliant performance comparisons—call Racal-Vadic today, toll free, at **800-482-3427**.

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CIRCLE 732 ON READER SERVICE CARD

Our new screen eliminates shady characters.



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Take the Multi and run.
MultiSpeed EL

Now the world's fastest portable computer makes every character bolder and brighter.

That's because the new MultiSpeed EL has a backlit screen. Which means you can easily read it anywhere you choose to use it. On the plane. In the car. Even in the dark.

This is the portable that combines a clock speed of 9.54 or 4.77 MHz with the NEC 16-bit V-30 processor and 640K RAM. So it's not only quick, but powerful enough to do most anything a desktop can do.

Standard Features			
Clock Speed	9.54/4.77 MHz	Screen type	Backlit LCD
Memory	640K bytes	Keyboard	Full Size
Bits in Software	3 programs	Numeric Keypad	Separate
Disk Drives	Dual 720K (3.5")	Weight	11.5 lbs.

What's more, it's PC compatible. And even does windows.

You'll find the new MultiSpeed EL at ComputerLand, Connecting Point, Eczel, MicroAge and Sears Business Systems Centers. For product literature or the location of your nearest dealer call 1-800-447-4700.

If you already own a Multi and would like to upgrade your screen, or need technical information, call NEC Home Electronics (USA) Inc. at 1-800-NEC-SOFT.

You'll find your job a lot easier when you work with brighter characters.

NEW-AGE HOBOS HIT THE ROAD

Once upon a gentler time, when traveling men of leisure rode the rails across this country, spending their nights in hobo camps, the good burghers of the communities they visited would sometimes find odd chalk marks on the sides of their houses, or rings or crosses of stones in the dirt outside their garden gates.

Those were "hobo signs," marks left by these unticketed and undocumented travelers to identify for their colleagues of the road those houses where a kindly housewife might offer a plate of lunch, or a piece of pie, without calling the sheriff. A safe haven, in other words: an opportunity for brief, congenial contact with the workaday world.

Lately I think I've begun spotting in my travels, via jet planes and in expensive lodgings—much fancier means of travel and accommodation than those of hobos, though not necessarily more reliable or comfortable—signs of a latter-day traveling contingent, what may be the Electronic Age's analogue of those

markings or rings of stones.

These marks seem to be left by travelers who carry portable computers, and who grow weary of finding only hard-wired telephones with no reasonable means of connecting their machines' modems to their electronic lifeline. I keep noticing—most often in airline clubs at airports, but also in other more-or-less public places—that some earlier traveler has carefully made a slit of a couple of inches in the outer jacket of the cable emerging from these damnable telephones, then apparently stripped just an eighth-inch or so of insulation from the red and green wires within that cable.

It looks to me very much as if this has been done so that a traveler with a telephone cord equipped with tiny alligator clips at one end could plug that cord into his computer, then clip the red and green leads from that cord to the corresponding pair of newly revealed wires in the cable leading from the telephone to the wall.

How clever. How useful. How kind of these electronic hobos to leave behind

a discreet, nondestructive sign of safe haven, of safe passage to MCI Mail, AT&T Mail, Telemail, and the like, for their colleagues of the road.

An insurance executive I know who has also noticed the spread of purposely frayed telephone wires suggests that these modern hobo signs have been left by members of the elusive Club 232, a group apparently dedicated to fostering easier, more civilized electronic communications in our society.

Keep an eye open for this kind of hobo sign in your travels. And when you spot the sign in a useful public place, send us a note here at *PC Magazine*. Be specific: "third telephone from the left in the bank of phones in the no-smoking area at TWA's club at O'Hare," for example. We may find it necessary, in the public interest, to publish occasional listings of confirmed hobo signs.

—Jim Seymour

Jim Seymour is a columnist and contributing editor of PC Magazine.

modem and EMS memory board? You could use it as a RAMdisk."

And so they did.

As good as the Toshiba T3100 is, its slow hard disk just begs for a caching program or RAMdisk. And what good is a

1,200-bps Hayes-compatible modem.

This \$899 card is an impressive piece of engineering. Smaller than a PC half-card, it combines a 1,200-bps modem with 1 megabyte of RAM packed into Single in-line packages (SIPs) that stand the chips on their sides.

While the review unit worked just fine, it was clearly an early production unit. Blue wire and capacitors were soldered in and glued to both sides of the board, and one chip had several leads pulled from its socket with blue wires soldered to them.

The modem performed well on all of our standard tests, turning in results significantly better than average for 1,200-bps modems. *CrossTalk XVI* is included.

Tested as standard Expanded Memory, the EasyTalk EMS/T1200's memory section proved to be 20 percent faster than the Intel Above Board PS/AT. We were unable to test the EMS/T1200's extended (LIM EMS) memory functions, as our benchmarks only test EMS implementa-

tions that are entirely in hardware, and the EMS/T1200 uses a software setup.

The only problems with the EMS/T1200 are its cost (for \$899 you could almost buy a desktop machine) and the truly terrible documentation provided by Megahertz. The "manual" is only 18 word-processed 8- by 11-inch pages, and only 3 pages, one of them a diagram, cover the memory section. The manual does not list of Hayes commands supported.

The EMS/T1200 is a great idea for power users with money to burn. People who can't face being on the road without every spreadsheet they've ever created will be thrilled with this product.

MEGAHERTZ CORP. EasyTalk 1200

Megahertz's EasyTalk 1200 was one of the first Hayes compatible modems for the IBM PC Convertible, developed as a response to IBM's inexplicable decision to

■ The \$899 EMS/T1200 is an impressive piece of engineering and a great idea for power users.

laptop without a modem? Unfortunately, the T3100 has but one expansion slot, so you can have 2 megabytes of RAM or a modem, but not both. Into this void comes the EasyTalk EMS/T1200, a single board with 1 megabyte of EMS memory and a

"We've got to stop
meeting like this."



NOW YOU CAN AFFORD FAX AT YOUR FINGERTIPS.

Asher Technologies has created the first affordable, full-featured PC-based fax.

Stop walking and waiting.

Now, instead of walking back and forth to the fax machine, and waiting around, you can send and receive fax messages from your desk. For just \$395, the half-card JT Fax Internal fits inside your personal computer

and turns it into a full-featured fax machine. And for \$495 JT Fax External plugs into your portable or lap-top computer.

All the features, 1/3 the price.

Asher has streamlined PC-based fax, eliminating most of the cost but keeping all the features. So you get the easy-to-use screens, auto dialing, applications compatibility, and high-

speed transmission of PC-based fax devices costing \$1,000 and \$1,200. But you pay only \$395.

Get the fax.

Contact Asher Technologies, 1009-1 Mansell Road, Roswell, GA 30076. Or call 800-334-9339 or 404-993-4590. FAX: 404-642-1894.

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■ LAPTOP ADD-ONS: MODEMS



Modems for Laptops: Summary of Features

(Products listed in ascending price order)

	List price	Internal or external	Size (HWD in inches)	Weight (ounces)	Speed (bps)	Communications software included	Protocols supported Bell	CCITT
 Worldport 1200 Touchbase Systems Inc.	\$199	External	4 x 2.4 x 1	6.5	300/1,200	None	103,212A	V.21, V.22
Migent Pocket Modem MM1200 Migent Inc.	\$259	External	5 x 2.5 x 1.25	5.6	300/1,200	BitCom	103,212A	None
The Correspondent-IBM Holmes Microsystems Inc.	\$299	Internal	N/A	N/A	300/1,200	Mirror II	212	V.22
The Correspondent-T Holmes Microsystems Inc.	\$299	Internal	N/A	N/A	300/1,200	Mirror II	212	V.22
The Correspondent-Z Holmes Microsystems Inc.	\$299	Internal	N/A	N/A	300/1,200	Mirror II	212	V.22
EasyTalk 1200 Megahertz Corp.	\$400	Internal	N/A	N/A	300/1,200	Crosstalk XVI	103, 212A	V.22
EasyTalk EMS-T1200 Megahertz Corp.	\$899	Internal	N/A	N/A	300/1,200	Crosstalk XVI	103, 212A	V.22

 indicates Editor's Choice. N/A—Not applicable; size and weight measurements apply to external modems only.

sell its laptop with a modem that used only the IBM command set.

Megahertz quickly capitalized on this faux pas and was selling Hayes-compatible modems just months after the Convertible's introduction, throwing in *Crosstalk XVI* at no extra cost.

The EasyTalk 1200's documentation is much better than that for the EMS/1200. It

includes a very detailed set of installation instructions complete with line drawings that show you just what the system should look like each step of the way. This is a good thing, since installing a modem in the PC Convertible is about as easy as lifting a Mack truck and about as much fun as undergoing root canal work.

The manual is still devoid of all programming information and command descriptions. This is your basic meat-and-potatoes modem, and frankly there isn't anything here to make it worth the extra \$100 over the Holmes modems.

MIGENT INC.

Migent Pocket Modem MM1200

The Migent Pocket Modem MM1200 was the darling of our May 12th communications blockbuster issue (Volume 6 Number 9). Its Ferrari-red case and Ghia styling led us to state that this modem may become a

new technological status symbol.

The folks at Migent haven't been sleeping since May 12. The \$259 Pocket Modem now includes a carrying pouch, 18-inch cables for both 9- and 25-pin serial

■ The Pocket Modem is a small, rugged system improved by the addition of the carrying case and the new AC adapter.

ports, and the smallest AC adapter I've ever seen. The manual is much improved, and a complete manual is included for the *BitCom* communications package that comes with the modem. What in May was



FACT FILE

EasyTalk 1200
Megahertz Corp.
2681 Parley's Way, #2-102
Salt Lake City, UT 84109
(801) 485-8857
List Price: \$400

In Short: A Hayes-compatible internal modem for the IBM Convertible. Includes *Crosstalk XVI*.

CIRCLE 646 ON READER SERVICE CARD



Who says you can't please everyone?

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Datavue is the industry leader in portable technology. We were first with backlit screens and super-twisted crystal LCD screens. We were first to introduce a laptop with a half-card expansion slot. And now we're first to offer a choice of laptops to fit most every need.

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retractable built in handle, 384K expandable to 640K memory, a mechanical touch keyboard and more.

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20Mb hard disk, the Datavue 20 Meg is designed to handle the big jobs. It also has a 3.5" internal floppy disk drive and all the other features you're looking for like built-in RAM drive software, a full-size amber gaslight screen, a detached 83-key mechanical-touch keyboard and modem capabilities.

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For more information contact us at One Meca Way, Norcross, GA 30093, (404) 564-5555.

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FACT FILE

Migent Pocket Modem MM1200

Migent Inc.
865 Tahoe Blvd.
P.O. Box 6062
Incline Village, NV 89450
(702) 832-3700
List Price: \$259

In Short: A stylish shirt-pocket-size 1,200-bps modem that performs well. Includes AC adapter, carry case, BitCom software, and cables.

CIRCLE 644 ON READER SERVICE CARD

a few stapled pages is now a complete, typeset user guide.

The Pocket Modem now works just fine without a telephone plugged into its second jack, correcting a problem our reviewers had with the previous Pocket Modem we tested.

The Pocket Modem is small, Hayes compatible, and rugged enough to stand up to the PC Labs sumo wrestler test. The Pocket Modem we tested for this article didn't perform as well on the TAS modem test set as did the one we had in May; we attribute the differences to manufacturing variations.

There's still room for improvement here: I particularly dislike the way the Pocket Modem sends your computer a Ctrl-G to make the bell ring as a low battery indicator. Ctrl-Gs are common false characters on noisy lines, and a Ctrl-G in the middle of a file transfer won't make your computer beep—it will just screw up the block being sent. An LED indicator would be an improvement; a beeper in the modem that would go off when the battery is low would be better still.

The Pocket Modem could also use an acoustic cup adapter and support for the CCITT signaling systems used overseas (Touchbase's Worldport 1200, reviewed here, offers this feature).

The competition has also caught up with Migent in the area of size. In fact, the Worldport 1200 is smaller and performed better on noisy phone lines (see the summary of features table).

The Pocket Modem is a small, rugged, and stylish system improved by the addi-

tion of the carrying case and AC adapter. Recommended to all Lamborghini owners and Armani devotees.

TOUCHBASE SYSTEMS INC.

Worldport 1200

While Migent's Pocket Modem is the design award winner among shirt-pocket modems, the Worldport 1200 is just an excellent modem in a plain brown wrapper. A full inch smaller than the Migent, the \$199 Worldport includes four LEDs, performs better under bad line conditions, and lists for \$60 less.

Touchbase Systems even remembered that people with portable computers sometimes have to deal with hotel phones that don't have modular jacks. The Worldport includes an adapter so that you can use Radio Shack's acoustic coupler for these situations. You can even pretend you're in an HP commercial and pull into a phone booth to MCI-mail that brilliant new idea back to the home office.

Although Touchbase claims the cups work at 1,200 bps, my testing showed that 1,200-bps performance was very sensitive to the telephone and handset used, but 300-bps communications were always error-



EDITOR'S
CHOICE

FACT FILE

Worldport 1200

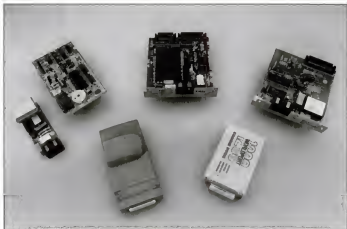
Touchbase Systems Inc.
16 Green Acre Ln.
Northport, NY 11768
(516) 261-0423
List Price: \$199

In Short: The world's smallest external modem, and the only one supplied with an acoustic cup adapter and diagnostic LEDs. A top performer, it is also upgradable to 2,400 bps for \$199 (upgrade includes Carbon Copy software). Strongly recommended.

CIRCLE 643 ON READER SERVICE CARD

free. The acoustic coupler adapter uses the same connector as the AC adapter; hence you can only use the cups while on battery power.

Since batteries last just 10 hours, you may need a pocketful of Duracells for a long trip. But Touchbase's engineers stayed up late to figure out how to squeeze the most out of those Duracells. The Worldport is powered up only when your computer is asserting the DTR (pin 20) signal on its serial port. This signal is asserted



Three machine-specific internal modems and two pocket-size external modems cost less or do more: from left to right, in front, the \$259 Migent Pocket Modem MM1200 and the \$199 Worldport 1200; from left to right, in back, the two parts of the \$400 EasyTalk 1200 (detachable phone jack and modem), the \$899 EasyTalk EMS/T1200 with 1200-bps modem and expanded memory, and The Correspondent-T, which lists for \$299, the same amount as the IBM and Zenith versions.



The inventors of the 3.5" drive recommend only one floppy disk. Theirs.

If your computer has 3.5" drives, it has a little bit of Sony. Because Sony invented the 3.5" drive technology that has taken floppy disk memory all the way to two megabytes.

So nobody knows better than Sony how important high standards are for producing 3.5" floppy disks. But then, Sony invented those, too, as well as the most demanding methods for making 3.5" disks.

Such as the Sony Vivax™ magnetic medium, with the high coercive force necessary to suppress the "noise" that can cause disk error. And the Sony DDL™ binder system for incredibly even dispersion of magnetic particles on the disk surface. Then there's Sony's burnishing expertise that eliminates microscopic projections as small as 1/1,000,000th of a millimeter.

But the best reason to trust only Sony is your irreplaceable data. After all, you'll be storing six times the information on a disk that's one-third smaller than a 5.25" floppy. That's why we recommend only one floppy disk for our 3.5" drives. The Sony.

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THE ONE AND ONLY.

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THE FLOPPY DISK READER HEREIN IS A TRADE NAME.

SONY ELECTRONICS OF AMERICA

only after your modem program initializes the serial port. The Worldport can even be powered with +12 volts DC on pin 9 of the serial port.

Touchbase has made some improvements in the design of the Worldport. It now has thumbscrews to attach it firmly to your computer, and, unlike the Migent, it doesn't have a lip around the DB-25 connector that makes it hard to plug the Migent into the interface port of some computers.

The Worldport's LEDs make it much easier to find out what's going wrong when you can't get the MCI Mail node in Caracas from your hotel room in Quito. The lights are especially welcome since the Worldport (like the other shirt-pocket modems) has no speaker to sound an alarm or give status information. The LEDs display Low Battery, High Speed (1,200 bps), Carrier Detect, and Call in Progress conditions. The Low Battery LED in particular can be a godsend.

If a shirt-pocket modem is in your fu-

Portable Printers: Two for the Road

*Get hard-copy printouts—
wherever you are—
with these compact,
lightweight models.*

PC EDITOR'S CHOICE

• Worldport 1200

The Worldport 1200 from Touchbase Systems is a superior product at an attractive price. The smallest modem on the market, the Worldport also is the only modem of its size that is supplied with an acoustic cup adapter and diagnostic LEDs. The recently announced Worldport 2400 should also be a winner. You can upgrade from the 1200 for \$199—a great deal, since the upgrade will be available before the standalone 2,400-bps version, and the 1,200-bps modem plus the upgrade costs less than the 2400 will.

ture, I strongly recommend that you find room for this 4- by 2.4- by 1-inch, 6.5 ounce wonder.

Howard Marks is an independent systems consultant and free-lance writer based in New Jersey.

Some people question the value of portable printers. Isn't it easier, they ask, to simply wait until you get home to print out your work? Or why not just use someone else's printer—it's simple enough to hook up your laptop computer to a standard interface. Valid points, but still there are many people who want to leave behind copies of their work for others or who like to make notes on paper copies of reports—people who, in short, want quick printing wherever they are. That's where lightweight, compact printers come in.

What makes a printer portable? We classify a portable printer as anything under about 8 pounds—ideally, we'd like to see them no heavier than 5 pounds, but that isn't always possible. A portable printer should be rugged, offer decent print quality, be able to run off battery and AC power, and be compact enough to fit into the

same case as your laptop computer.

Two of the best laptop printers come from Axonix Corp., which, besides its Axonix ThinWrite 100 printer, also makes an add-in drive for the Toshiba T1100 Plus and a variety of Toshiba accessories, and Diconix, whose 150 InkJet Printer remains the darling of jet-set power users. Watch for more small printers in our upcoming printer special in October.

—Nora Georgas

AXONIX CORP.

Axonix ThinWrite 100

The Axonix ThinWrite 100 is better described as a luggable than a portable printer. At 6.5 pounds this beige-and-gray (don't manufacturers ever get tired of those colors?) beauty is just a bit heavy to twirl lightly around your finger as you trip gaily down the street. Still, its compact di-

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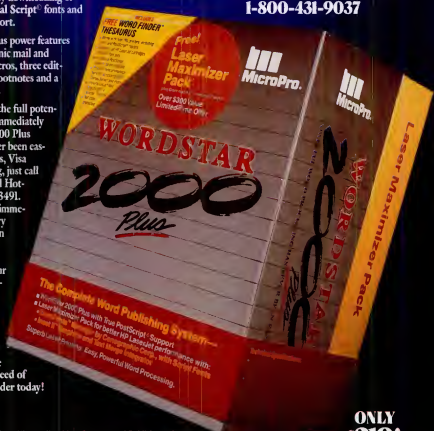
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LIVE LIKE ROYALTY

Sweepstakes

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The Grand Prize villa is owned by royalty, and used by their family and friends. You'll enjoy the same exact luxuries the owners do—the housekeeper, the gardener, the cook, the Land Rover, the private beach, the swimming pool—need we say more!!!!

Yes, we do!! You'll live on the same tiny island as, uuhhh, right next door to, uh, er, let's just say oodles of famous people—rock stars, politicians, movie stars, more royalty—people you only read about in the National Enquirer!!

You'll enjoy all these sensuous pleasures in a secret place in the West Indies, at the villa of a royally famous individual. So royal and so famous that we can't even tell you who it is!! Due to protection of privacy, we had to sign a contract stating that we would not disclose the owner of the villa, nor the exact location of the island. So nobody knows, with the exception of the pilot (someone has to get you there!!), and of course you, the winner.

But who cares?? For 1 whole entire week it will be yours and only yours, to use but not abuse; to use the same "water closet"—use!! (Ha!! Thought we'd give the secret away??)

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Smartmodem 2400

Smartmodem 2400B	
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LOGICSOFT

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*2400B	\$159

MIGENT

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TOSHIBA

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Inverted Foldout slip-sheet



GbaSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page

2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

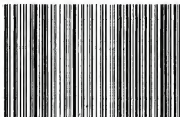
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



ObslipBack-001B

Back

1. Follow instructions on the other side

NEY-BACK G

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Ohh, my, my, what a sweepstakes!! Just look at where you could go—

GRAND PRIZE 8 days and 7 nights for four people at a Caribbean island villa, including round trip air fare.

But that's not all —

FIRST PRIZE (3 winners) choose any one of three (3) vacation packages for two including airfare A) One week Caribbean cruise departing from San Juan; B) One week in Honolulu; C) One week in Acapulco.

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EVERYBODY WINS a \$100 TravelDollars certificate*, redeemable on any vacation package, including air and ground accommodations, from a printed brochure. Just go to any travel agent and find a vacation package that most appeals to you, and bring the printed brochure home with you. Then call the telephone number on the back of your TravelDollars certificate, explain what you wish to do, and the reservations will be made. It's that simple!!

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SO, C'MON, CALL LOGISOFT NOW, AND LIVE LIKE ROYALTY!!

*TravelDollars certificates can be used with any vacation package including air and ground accommodations from a printed brochure. Minimum purchase \$500 per person. Certificates cannot be combined for use on a single trip.

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2. Winners will be selected in a random drawing by an independent judging organization about January 15, 1988. Winners will be notified by mail and may be required to sign an affidavit of eligibility and liability publicly release within 21 days of notification. Travel companion of winners will be required to sign releases. All taxes are the sole responsibility of winners. Odds of winning depend on number of entries. All prizes will be awarded. No transfer of prize and no substitution except by Logisoft due to prize unavailability.

3. PRIZES: One (1) Grand Prize of a one week (8 days, 7 nights) vacation for four people at a Caribbean island villa consisting of round trip air travel from any international airport

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■ LAPTOP ADD-ONS: PRINTERS



The Axonix ThinWrite 100 offers a variety of power options and a good selection of interfaces. Print quality is good, graphics are solid and dark. The printer performed well in IBM and Epson compatibility tests.

mensions (approximately 2.75 inches high by 12 inches wide by 8 inches deep) and 175,000-character battery life make it a contender to be the printer that goes with the man on the go.

Of course, a pretty face and a long life won't get you far if you can't back them up with something substantial, and the ThinWrite does. In fact, it is a remarkably versatile performer.

For instance, the ThinWrite will operate in any of three power modes: AC when it is connected to the wall through its ThinCharge III AC charger adapter; recharging mode, while its batteries are being recharged by the ThinCharge III charger adapter, and portable battery operation.

The same versatility is seen in its interfaces. The ThinWrite offers both Centronics parallel and RS-232C serial connectors, so it can be used with any computer that offers one or the other interface. Which connector is actually used is determined by setting one of the ThinWrite's fat array of 20 DIP switches (other switches control baud rate and parity for the serial mode, print mode, character set selection, and so forth).

With seven DIP switches relating to the serial connection, setting up the ThinWrite for serial use can be challenging. Thus it's a nice touch that the excellent manual accompanying the printer includes instructions for setting up the printer with four popular portables—the Kaypro 2000, Data General One, Epson PX-8, and Hewlett-Packard 110—as well as instructions

on how to set up the computer correctly.

It can take a while to get past the DIP switch section of the manual, what with choosing whether or not to use a slashed zero and whether to expect a line feed with a carriage return, but once you make it through this section, setting up the rest of the printer is simplicity itself. The ThinWrite 100 uses an easily installed Brother cassette ribbon and accepts cut forms; when using the optional pin-feed unit, it works with continuous-feed fanfold paper.

The printer offers the standard array of typefaces and fonts, including draft (100 characters per second claimed, 50 cps achieved in the *PC Magazine* torture test), near-letter-quality, enlarged, condensed, double strike, emphasized, proportional, pica, and elite.

As set up at the factory, the ThinWrite offers Epson compatibility. Resetting SW2-2 changes the personality of the printer to IBM compatibility. Single-density (480 dots per inch), double-density (960 dpi), and quadruple-density (1,920 dpi) graphics are supported in both modes, as are downloadable graphics in the Epson mode.

The ThinWrite 100 did well on the *PC Magazine* compatibility tests for both Epson and IBM compatibility. Its print quality is good; its graphics solid and dark.

Packing the ThinWrite 100 to take on a trip isn't easy—it takes up a good deal of room in a bag, especially with its optional continuous-form tractor feed. The printer also has a somewhat brittle feel—you certainly wouldn't want to drop it often, and it might merit some padding if you're going to check it in with your luggage. Nevertheless, the ThinWrite gets high marks for versatility and output quality. Overall, the ThinWrite 100 is a solid and versatile middleweight that could well serve the needs of anyone who wants a portable printer.—B.G. Waldman

DICONIX INC.

Diconix 150 InkJet Printer

My first reaction to the Diconix 150 InkJet Printer was "Where's the rest of it?" At a trim 2 inches high by 10.8 inches wide by 6.5 inches deep the Diconix 150 seems incomplete—its svelte 3.75-pound shape



FACT FILE

Axonix ThinWrite 100

Axonix Corp.
2257 S. 1100 East
Salt Lake City, UT 84106
(801) 466-9797

List Price: \$499

Requires Parallel or serial port.

In Short: A competent printer that provides high-quality output. Somewhat bulkier than the Diconix 150 printer, but still a contender in the laptop printer field.

CIRCLE 648 ON READER SERVICE CARD

The PC Magazine Printer Guide



PC Magazine's Printer Guide provides data pertinent to your printer purchase decisions. Unless otherwise noted, results come from PC Labs benchmark tests and hands-on evaluations.

PRINT QUALITY

To allow you to judge text and graphics print quality, text samples are shown both in their actual size and enlarged four times. The graphics sample—the PC Magazine logo—was created with a program custom-designed by Decision Resources of Westport, Connecticut.



SPEED

Rated speeds were obtained from the manufacturer. Default refers to tested speed in draft mode and quality refers to tested speed in near-letter-quality mode for the Axonix, double-strike mode for the Diconix.

TYPE PITCHES

Information on type pitches was obtained from the manufacturer. To give you a point of reference, 10 characters per inch is typical pica type, 12 cpi is typical elite, and 17 cpi is typical condensed mode.

SOUND LEVEL

Sound level doubles for each 10-decibel increase under real-life conditions. The average printer pounds away at 72 decibels, indicated by a rule on the graph. Compare that with the 20 decibels of rustling leaves, the 50 decibels of the average office, or the 120 decibels of a rock concert. The blue bar shows the rated decibel level. The orange bar shows the measured decibel level. The Diconix generates less than 60 decibels, too low for our testing equipment to measure accurately.



FEATURES

Listings of each printer's printing and formatting features obtained from the manufacturers tell you how far beyond plain-vanilla printing it will go.

PRINTING FEATURES

- H Horizontal emphasis (bold)
- V Vertical emphasis (double strike)
- C Correspondence quality
- U Underline
- S Sub/superscript

FORMATTING FEATURES

- P Proportional spacing
- J Justified lines

- C Centered lines
- LH Variable line heights
- FL Variable form length
- HT Horizontal tabs
- VT Vertical tabs

COMPATIBILITY

The Printer Guide reports on each printer's character compatibility with IBM's low-order (ASCII code 0-127) and high-order (ASCII code 128-255) character set. Low-order characters represent the letters, numbers, and symbols found on the keyboard. The high-order IBM display characters include some line- and box-drawing characters that are useful for nongraphics drawing programs (see this issue's PC Lab Notes for a program that helps you make use of these characters).

Low-order characters



High-order characters



If your printer emulates (is compatible with) the text or graphics of a printer that your applications program supports, you'll have no trouble printing your output. We've listed each manufacturer's claims for its printer's emulation of some of the more-common printers.

Epson (FX, LX, MX series)
IBMGr

Epson
IBM 5152
Graphics Printer
IBM Proprinter

IBMPro

Portable Printers

(Products listed in ascending price order)

TYPE CARRIAGE WIDTH PRICE	SPEED: Characters per second	TYPE PITCHES: Characters per inch	FEATURES: Printing Formatting	SOUND LEVEL: Decibels	COMPATIBILITY: IBM char. set Graphics Text
------------------------------------	------------------------------------	--	-------------------------------------	-----------------------------	---

Diconix 150 InkJet Printer



Qm

Diconix 150: P
e. Underline. e
Double strike.
On Default. Dou
ized. Power On

Ink jet
8 inches

\$479

150 rated
82 default
29 quality

10.0
16.0

H V C U S
LH FL HT VT

45 < 60



Epson FX, LX, MX;
IBMGr; IBMPro
Epson FX, LX, MX;
IBMGr; IBMPro

Axonix ThinWrite 100



Qm

Axonix (Thin
uble Strike.
Default. Dou
d. Power On I
e. emphasize

Impact
matrix
(9 pins)
11 inches

\$499

100 rated
50 default
16 quality

6.0
8.0
8.6
10.0
12.0
17.0

H V C U S
P J C LH FL
HT VT

< 60 66



Epson FX; IBMGr
Epson FX; IBMGr

Quality Solutions *for*



United-286/12

- 80286 processor
- 1MB RAM
- Dual-speed 6MHz-12MHz
- 200-watt power supply
- Eight expansion slots
- One 1.2MB floppy drive
- Dual floppy/hard drive controller
- Keyboard
- Illustrated manual
- One-year warranty

Base System **\$1395**

Monographics System

- Twelve-inch, flat screen monitor with tilt and swivel base. **\$1555**
- With 40MB MiniScribe hard drive model 6053, 28ms access time. **\$2095**

EGA System

- EGA color monitor with 14" screen. **\$1975**
- With 40MB MiniScribe hard drive model 6053, 28ms access time. **\$2525**

United-286/10

- 80286 processor
- 10MHz processing speed
- 512KB RAM
- 200-watt power supply
- Eight expansion slots
- One 1.2MB floppy drive
- Dual floppy/hard drive controller
- Keyboard
- Illustrated manual
- One-year warranty

Base System **\$995**

Monographics System

- Twelve-inch, flat screen monitor with tilt and swivel base. **\$1155**
- With 40MB MiniScribe hard drive model 6053, 28ms access time. **\$1695**

EGA System

- EGA color monitor with 14" screen. **\$1575**
- With 40MB MiniScribe hard drive model 6053, 28ms access time. **\$2125**

United-286/8

- 80286 processor
- Dual-speed 6MHz-8MHz
- Space-saving compact chassis
- 512KB RAM
- Phoenix BIOS
- 200-watt power supply
- Eight expansion slots
- One 1.2MB floppy drive
- Dual floppy/hard drive controller
- Keyboard
- Illustrated manual
- One-year warranty

Base System **\$895**

Monographics System

- Twelve-inch, flat screen monitor with tilt and swivel base. **\$1055**
- With 40MB MiniScribe hard drive model 6053, 28ms access time. **\$1595**

EGA System

- EGA color monitor with 14" screen. **\$1475**
- With 40MB MiniScribe hard drive model 6053, 28ms access time. **\$2025**

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PORTABLE PRINTERS: WHY BOTHER?

Portable printers are great. I've used models from Sony, Axonix, and TTX, and these days swear by a Kodak Diconix 150—a wonderful little printer good enough to be the *only* printer for a lot of people whose work isn't particularly paper-output intensive.

But do you *need* a portable printer to go with your laptop PC? No way. In fact, as much as I enjoy using the Diconix, I don't often carry it with me.

My experience has been that when I need hard copy while traveling, I can almost always find someone who'll be kind enough to let me use his printer for a few minutes. In law offices, brokerage firms, manufacturing firms, sales offices, corporate headquarters—virtually anywhere I'm likely to be carrying a computer and need paper output—there's some nice person who'll let me plug into his printer. Hotel clerks have plugged my PC into their Okidata 82s; airline reservation clerks have shared their Tally 160LS.

One of the virtues of the PC-printer-standard 36-pin female Centronics connector is that it can be snapped open in a

second, without your having to crawl around through the trash, dead insects, and dust bunnies behind the printer with a flashlight and jeweler's screwdriver. Just pop open those wire brackets and your benefactor's printer cable is free of the printer. (Try not to drop it behind the desk, please.)

Get out your own cable and snap its male Centronics connector onto the printer. It's so easy you can do it by feel. Plug the other end into your PC and bingo: you're in business.

You don't *have* to carry your own printer cable, of course. But if you don't, you're probably going to have to unscrew the DB-25 connector at the PC end of your newfound friend's cable from his computer, which, aside from being less convenient for you, is likely to give him some second thoughts about whether this is such a good idea.

I carry a very compact printer cable, with standard IBM connectors but built with flat ribbon cable, sent to me by a kind reader. You can make one up easily, too. Ribbon cables don't last as long as round cables, but are one-tenth as bulky

and have less than one-fifth the weight of the round variety.

One trick that makes all this a lot easier is to carry on-disk a wide range of printer drivers for your software. I keep 20 or 30 *Microsoft Word* printer drivers and about that many Lotus drivers on the hard disk of my Toshiba T3100. But here's an even better trick: the Epson MX-80 driver works with almost every printer I've used. You may not get the boldfacing, underlining, italics, and other print attributes you're used to, but you will get the right letters and numbers, margins and tabs, and page breaks.

No matter how small and light vendors make portable printers, they'll never equal the 0- by 0- by 0-inch size and 0-pound, 0-ounce specs of my approach. And even the user-friendliest portable printer isn't nearly as friendly and interesting as the people I've met and talked with while as I've disconnecting and reconnecting their printer cables.

—Jim Seymour

Jim Seymour is a columnist and contributing editor of PC Magazine.

seems to need filling out somehow.

Once I'd realized that I was looking at the whole story, that no one was going to jump out of the woodwork with a supplemental sheet feeder or other external gadgetry, my next reaction was, "Oh, it's one of those." I figured it for one of the small, lightweight, and utterly useless thermal printers that companies such as IBM and Data General foist off on unsuspecting buyers as an ideal companion for a portable computer whose screen you can't read.

A few minutes with the Diconix taught me not to jump to conclusions.

Despite its diminutive size, this printer is no mere toy. What it might be, however, is the perfect portable printer for any occasion. It produces crisp, high-quality type at a brisk pace and, under battery power, will do a fine job on all your printing tasks anywhere you happen to be, from Mount Hood to Muscle Beach.

The Diconix 150 InkJet Printer is equipped with a standard Centronics 8-bit parallel interface, and it recognizes most of the IBM Proprinter/Epson FX command sets for text and graphics printing, so it passes the basic "is this thing at all usable" test. (Printers that don't use a standard parallel interface or that don't offer Epson emulation should get back under whatever rock they crawled out from, as far as I'm concerned.)

In addition, the Diconix 150 includes a 2K-byte buffer and offers a variety of print modes, including draft (96 dots per inch), quality mode (192 dpi, produced by two passes of the printhead), as well as script, condensed, super/subscript, enhanced draft, double-strike draft, enhanced quality, and double-strike quality displayed in normal, italic, emphasized, enlarged, proportional, or condensed typefaces.

The rated speeds for these features

range from a high of 240 characters per second for condensed to a low of 29 cps for enhanced or double-strike quality type, with layovers at 150 cps for draft mode and 50 cps for most of the others.

EDITOR'S CHOICE



FACT FILE

Diconix 150 InkJet Printer
Diconix Inc., a Kodak Co.
3100 Research Blvd.
Dayton, OH 45420
800-DICONIX
List Price: \$479
Required: Parallel port, AC outlet or five C size nickel-cadmium batteries.
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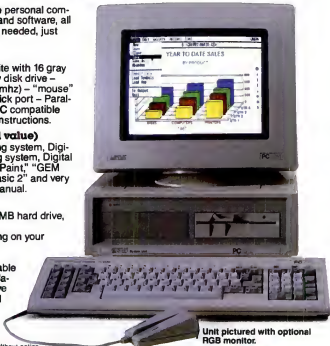
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■ LAPTOP ADD-ONS: PRINTERS



The Diconix 150 is a compact little ink-jet printer that will fit in a good-sized bag along with your laptop computer. It runs off AC power or C-size batteries and it produces crisp, high-quality type at a brisk pace.

Those are all fantasy figures, of course. Like every other printer manufacturer, Diconix thinks that a second takes about twice as long as the rest of us know that it does, but still, the Diconix printer will produce draft-mode type at about 62 cps an impressive feat for one so small.

EDITOR'S CHOICE

• Diconix 150 InkJet Printer

A beautifully designed unit, the Diconix 150 InkJet Printer produces surprisingly good text and graphics output, but it's still small enough to fit into a briefcase and light enough to take anywhere. It takes all the pain out of carrying a printer with you and produces high-enough-quality output to double as your desktop printer.

Graphics printing is unidirectional. At 566 dots per line in low resolution and 1,133 dpi in high resolution, the printer produces very sharply detailed graphics. However, because the Diconix uses a smaller vertical dot pitch than most printers ($1/16$ inch instead of $1/17$), graphics tend to be reduced to about three-quarters of their intended size when printed. The proper proportions are maintained, however, because the bit-image horizontal dot pitch is reduced to $1/16$ inch, as opposed to $1/16$ inch on most printers.

In addition to the way that it reduces graphics, the Diconix differs from perfect emulation of the Epson in a few other ways. It does not accept downloaded fonts, use quad-density graphics, or print 10-pitch fonts. Nor does it support reverse line feed, half-speed printing, or the paper-empty function. Some of these are serious omissions. Nevertheless, when you are on the road, you are not likely to need functions such as reverse line feed very often, and thus for use with a portable computer, the Diconix 150's compatibility shortcom-

■ LAPTOP ADD-ONS: PRINTERS

ings can easily be forgiven.

Actually, you'll probably never even notice those omissions. On the whole, the emulation is quite strong. For instance, the Diconix 150 breezed through the *PC Magazine* Epson and IBM emulation tests like a champ.

The emulation mode and power-on settings are set through an internal DIP switch and can be changed through either escape codes or the more accessible front-panel switches.

Setting up the printer is fairly simple, although first-time setup can be difficult since the manual does not adequately describe how the ink jet printhead should be inserted into its case. The printhead also tends to leak ink when it is manipulated, so you can count on messy fingers the first time you set the thing up. Once you know what you're doing, however, setup is a quick and clean job.

The Diconix 150 can run off either AC or battery power. For plug-in-the-wall operation, it makes use of a small lightweight power supply that converts the AC juice to

jet printhead, which is rated for only 500 pages of printing. When you're planning a trip on which you intend to do a lot of printing, you should remember to take an extra printhead along with you.

That caveat aside, the Diconix 150 InkJet Printer is one of the most impressive little boxes I've seen. It does everything it promises and does it all well.

—B.G. Waldman

■ Despite its diminutive size, the Diconix 150 InkJet Printer is no mere toy.

9-volt DC power. For battery power, the printer requires five C-size nickel-cadmium rechargeable batteries. The batteries fit into the printer platen—one of the cleverest designs I've seen. The printer's AC adapter also functions as a battery charger, another nice touch.

The printer uses either special coated "ink jet" paper or standard paper, both of which should be tractor-fed. Print quality is better (darker) on the special paper, but is also more than acceptable on standard printer paper.

One concern with this printer is the ink

"LAP-LINK IS NOTHING SHORT OF INCREDIBLE..."

Jerry Pournelle
Byte Magazine, July 1987

They are still talking about LAP-LINK release #1. It has achieved virtually an unanimous editor's choice as THE solution for connecting laptop PC's and the new IBM PS/2 series with any 5 1/4 inch disk PC. LAP-LINK eliminates the need to purchase expensive external disk drives. Even if you own an external disk drive, LAP-LINK's incredible transfer speeds are much faster than a normal disk copy—transfer megabytes of information in just minutes! And since LAP-LINK weighs only ten ounces (cable and disk), you can easily carry it with you for instant connectivity at any location.

Unlike other transfer programs, there is absolutely NO installation required to use LAP-LINK. No messy changes to your CONFIG.SYS file or rebooting. Just type "LL" and LAP-LINK

automatically connects itself. And LAP-LINK works between any version 2.xx or 3.xx of the MS-DOS/PC-DOS operating system.

LAP-LINK users couldn't agree more with Jerry Pournelle, "I don't know if the manual is any good or not: I've never had any reason to open it. LAP-LINK is so thoroughly intuitive, fast and simple to use that the manual is blooming near superfluous. This is one of those products that sets standards: it does what it's supposed to do, does it well, and does it without fuss or bother...."

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CIRCLE 223 ON READER SERVICE CARD

Nora Georgas is an associate editor of PC Magazine. B.G. Waldman is free-lance writer for PC Magazine.

Ten Megs Never Felt Lighter

*Two companies bring
hard disk convenience to the
Toshiba T1100 Plus.*

A hard disk in a laptop computer seems eminently reasonable, doesn't it? Floppy disks, even the 3½-inch variety, are enough of a hassle at home, let alone on the road. Who wants to carry a handful of the blessed things all over the country, only to find as you sit in a hotel room in Fort Worth that you've left behind the one disk you really need?

Probably in order to keep costs and power drain to a minimum, Toshiba didn't equip its otherwise near-perfect T1100 Plus laptop with a hard disk option. Too bad, but not a tragedy, since at least two companies (maybe more by the time you read this) have jumped in with 10-megabyte add-in disks for the T1100 Plus. Axonix Corp. and Premier Technologies offer JVC-built drives that give you hard disk convenience and capacity on the road. Both units weigh less than a pound, fit into the second disk drive slot on the Toshiba, and work just like the hard disk in your desktop machine. Both are able to power-down when not in use, so the battery drain isn't as bad as you might guess.

Drawbacks? Only two, really. First, you can't install these drives yourself, so you might have to give up your laptop for up to a week while a dealer—or, in the case of the ThinWin, Axonix factory personnel—fit the drive into the computer. And these drives certainly aren't a bargain—\$995 for the Premier disk and \$1,195 for the Axonix product. This surely makes them the most expensive 10-megabyte hard disks on the market. Maybe the price reflects the costs of "ruggedizing" the disks to stand up to life on the road but more likely it's a question of monopoly. After all, consider the alternatives.

Both companies are working on 20-megabyte versions due out this fall, but for now you'll have to muddle along with 10 meg.

AXONIX CORP.

ThinWin 1100-10

Axonix's ThinWin weighs 8 ounces, costs \$1,195, and has to be factory installed. Since you won't be putting the drive into the machine yourself, the only physical

change you'll notice when your Toshiba comes back from its little operation is a beige plastic panel where the second drive slot used to be. And, of course, the C prompt on your screen.

The ThinWin comes formatted with DOS 2.11, and you need a Version C BIOS in the machine for the disk to run; if the T1100 Plus has an A or B version, Axonix will install the C type. Though formatting is supposed to be done along with installation, the manual includes full instructions for using FDISK, COPY, and FORMAT with the disk, as well as a section on creating partitions.

The ThinWin runs off the Toshiba battery for 2 hours with no use, and just over an hour with 10 percent use. The disk powers-down when not in use to reduce battery drain. The ThinWin is connected to the lower drive (B) light, on the front panel of the Toshiba, and both the low battery and lower drive lights will come on 15 minutes before the power is about to go.

In AC operation, the ThinWin needs more than the 9 volts supplied by the Toshiba AC adapter. Axonix supplies a special adapter that lets you use the hard disk when the computer's batteries are discharged. Even so, the manual recommends that you charge the batteries for 15 minutes before turning on the computer because running the machine completely discharged can damage the battery.

Access time on this drive isn't brilliant, but it beats a floppy disk drive. Axonix quotes a 98-millisecond access time; our benchmark tests couldn't verify that because both the ThinWin and Premier's LiteDrive have lower rotational speeds



FACT FILE

ThinWin 1100-10

Axonix Corp.
2257 S. 1100 East
Salt Lake City, UT 84106
(801) 466-9797

List Price: \$1,195

Requires: Toshiba T1100 Plus.

In Short: A fine addition to the Toshiba T1100 Plus, but more expensive than the LiteDrive. Lacks the setup and utility software offered by Premier Technologies.

Circle 84 on Reader Service Card



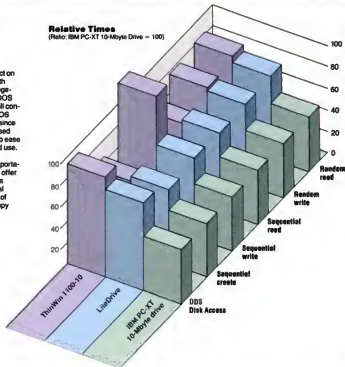
Benchmark Tests: Portable Hard Disks

Mass storage, yes; speed, no, is the verdict on this sampling of portable hard disks. Both models trail the IBM PC-XT's standard 10-megabyte hard disk by substantial margins in the DOS Disk Access test and by less dramatic, but still considerable, margins in the File Access test. BIOS Disk Seek test results could not be obtained since the portable hard disks incorporate a decreased rotational speed (approximately 2,300 rpm) to ease power requirements during initial start-up and use.

While the LiteDrive is the speedier of the two portables in all but two operations, both hard disks offer a quantum improvement over the disk access times of a floppy drive. This may be the critical factor: when the issue is portability, the point of comparison is the portable competition—floppy disks—not desk-based fixed drives.

Relative Times

(Ratio: IBM PC-XT 10-Mbyte Drive = 100)



Performance Times

(Times given in seconds except where noted)

File Access

	DOS Disk Access (milliseconds)	Sequential create	Sequential write	Sequential read	Random write	Random read
ThinWin 1100-10	193.70	18.65	29.82	16.86	48.33	39.49
LiteDrive	170.23	17.80	18.56	17.63	46.30	36.52
IBM PC-XT 10-Mbyte drive	103.85	12.80	12.53	12.14	31.15	24.06

The DOS Disk Access benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3 and the inaccess factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The File Access benchmark test measures the time it takes to sequentially create and write a 256K-byte data file using record lengths of 512 bytes and 4K bytes. The test program then performs a series of operations: a sequential read of the same file, a random write, and a random read.

than normal (reducing power consumption) and so were incompatible with the PC Labs BIOS disk seek benchmark test. But taking the lower speed into consideration, access time should be between 100 and 120 milliseconds, so Axonix's claim appears within reason. In the DOS Disk Access benchmark test, the ThinWin was

slower than the Premier model by about 20 milliseconds but proved to be faster in other areas. It's quite a bit slower than a regular Seagate disk on an IBM PC-XT, but it's an improvement over floppy disk access.

The ThinWin is shock-mounted to withstand up to 70 g (when it's not operating) and 6 g when in operation. (The Air-

line Transportation Association recommends equipment that is checked on airplanes to be resistant to at least 35 g. Still, it's a better bet to keep the computer with you on the plane.)

Our evaluation Axonix disk made two cross-country trips without so much as a whimper and seems to be a solid product.

POWER TRIPS

Some people will do *anything* to take their Toshiba T3100s on the road with them: Executive editor Bill Howard recently spotted a guy running a T3100 off the AC plug under the seat of a New Jersey commuter train. Considering that the train itself stops when the lights go on at the nearby Giants Stadium, the intrepid power user was either very brave—or real dumb.

An easier solution might be to invest in the AdaptaPak 80—a combination product that includes a car lighter adapter and a lead acid battery with recharger that provides up to 1½ hours of battery life for the formerly AC-bound T3100.

Like any freedom, however, it doesn't come cheap. The AdaptaPak costs \$399 and weighs 7 pounds. That's about a pound more than Toshiba's latest laptop, and a lot more than most of us are willing to carry around. A spokesman for Product R&D Corp., the AdaptaPak's maker, said that the company's philosophy was that no battery should weigh more than half the weight of the computer it's intended for—and since the T3100 weighs around 16 pounds, the 7-pound AdaptaPak is just fine.

Maybe they're right: What's an extra few pounds to someone willing to carry a T3100 in the first place? And Product R&D packages the AdaptaPak 80 in a smart black padded fabric case that



The AdaptaPak 80 kit from Product R&D Corp. includes the 7-pound battery (center), AC adapter (left), and car/boat adapter (right), plus carrying cases (top). Find room for all of this in your suitcase and presto! an hour and a half of battery life for your Toshiba 3100.

matches the styling of Toshiba's bag for the T3100. The case has rings for a shoulder strap (also included) and loops on the back that can only be explained as a way to hook the AdaptaPak to your belt! Kids, don't try this at home.

The AdaptaPak is easy enough to use—just please, please don't brush aside that little white slip of paper inside the box, because it's the only indication you'll get that you **MUST** switch the voltage on the T3100 from 110 volts to 230 before running the AdaptaPak with the computer. If you don't, the next indication you'll get will be the unmistakable "pop" of an electrical short, followed by a blank screen and perhaps a little smoke. This doesn't seem to affect the computer but it pretty much destroys the battery.

Yes, everyone should read directions. Yes, the little white paper states clearly that the voltage must be changed. But I'll bet most people, seeing the simplicity of the setup, will be tempted to just plug in the battery and get going. Why not put a

big red sticker or something equally obnoxious right on the side of the AdaptaPak to prevent hapless users from blowing their latest purchase to bits?

Product R&D rates the battery's life at 1½ hours. On our tests, it conked out after 45 minutes, but that's with very heavy disk access. With normal access you should be able to wring out another half hour or so of use.

The bottom line is that if it's *that* important to you to use your T3100 away from an AC outlet, you'll buy the AdaptaPak and love it. If you're an exercise nut, buy two and use them as weights.

There's obviously a demand for this sort of thing. Product R&D just announced two battery packs for the Compaq Portable III: a 7-pounder for \$395 that provides 45 minutes of operation, and—ready?—a 13-pound model that gives an hour and a half. It costs \$445.

Where's miniaturization when we really need it?—Nora Georgas



FACT FILE

AdaptaPak 80

Product R&D Corp.
1194 Pacific St.
San Luis Obispo, CA 93401
(805) 546-9713
List Price: \$399

Requires: Toshiba T3100.

In Short: A heavy (7 lbs.) but workable solution for those who must run their T3100 away from an outlet, even if the charge lasts for only 1½ hours.

CIRCLE 608 ON READER SERVICE CARD

It's not if you'll lose data. It's when.

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These simple, low-cost tape backup systems are specially designed for the IBM PC, XT, AT and compatibles, as well as the IBM Personal System/2 product families. When data is lost, just insert your backup data cartridge in the tape drive and stream the data back onto your hard disk. Data salvation is just a few keystrokes and just minutes away. All this protection takes up precious little space—even as little as a 3.5 inch floppy disk drive. And the ArchiveXL systems are complete with everything

you need for maximum data protection—including Archive's QICstream™ utility software.

A final thought, the ArchiveXL and ArchiveXLc are based on QIC-40, the tape interchange standard for data compatibility. That's a big Archive extra.

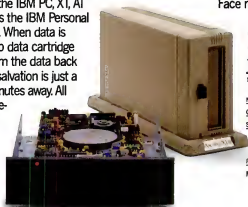
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■ LAPTOP ADD-ONS: HARD DISKS

Axonix is planning a \$1,395 20-megabyte disk for introduction this fall, and a 10-megabyte drive for the NEC MultiSpeed will be released soon. In fact, Axonix has a whole lineup of laptop add-ons, including the ink jet printer reviewed in this issue (see "Portable Printers: Two for the Road"), a slim-line expansion box for the Toshiba (not available for this review, but it puts Toshiba's own unit to shame), and a variety of other accessories.

PREMIER TECHNOLOGIES INC.

LiteDrive

The LiteDrive adds only 6 ounces to the weight of your Toshiba T1100 Plus or NEC MultiSpeed; it can be installed by a dealer in as little as 15 minutes. The \$995 price includes a utilities disk that helps you set up partitions, organize subdirectories, and perform a variety of hard disk setup and housekeeping functions.

Security functions are also included in the software: you can protect the drive with a password that can be changed as often as you like. It's easy to set up and a nice feature to have.

Like the ThinWin, the LiteDrive powers-down when not in use, but LiteDrive users can program the disk to shut down after a certain number of seconds. Any read or write command reactivates the drive. This drive takes even less power than the ThinWin; Premier Technologies claims that the disk will operate for 6 hours on battery power with normal use, and for over 2 hours with constant access. Of course, the 6 hours is longer than the computer itself will run on battery power, but

PC EDITOR'S CHOICE

• LiteDrive

Both drives are good performers—important steps in bringing true power to laptops. Two ounces lighter and \$200 cheaper than Axonix's ThinWin 1100, Premier Technologies' LiteDrive is our choice for a laptop hard disk. Battery life is longer, and the LiteDrive includes setup and utility software that the ThinWin does not. Plus, with the LiteDrive you get While-U-Wait dealer installation at 300 to 400 locations. You never have to let the computer out of your sight.

it's nice to know about the drive's stamina.

The head on the LiteDrive parks after 6 seconds of no access, protecting the disk from crashes.

The LiteDrive has the same shock resistance rating as the ThinWin—no big surprise really, since it's virtually the same drive. The only differences appear to be in the controller and in the software.

In our tests, the LiteDrive had faster access speeds than the ThinWin, but it's still not fast enough to make you want one in your AT. We took the drive on a couple of trips and it behaved perfectly. Like the ThinWin, it makes metallic clicking noises when it's working; these can be alarming when first heard, but you soon get used to them.

This drive is cheaper than the Axonix model and appears to offer a lot more in the way of software control. There's also the difference between surrendering your computer to a factory for a week as you have to do with the Axonix drive, and simply taking the machine and drive into a dealer and waiting while it's installed. Premier also makes a drive for the NEC MultiSpeed (\$995).

Keep an eye out for Premier's 20-megabyte drive, due out this fall.

Nora Georgas is an associate editor of PC Magazine.

PC EDITOR'S CHOICE FACT FILE

LiteDrive

Premier Technologies Inc.
1890 McGraw Ave.
Irvine, CA 92714
(714) 261-1184

List Price: \$995

Requires: Toshiba T1100 Plus.

In Short: A lightweight, reasonably priced hard disk for the Toshiba T1100 Plus. Includes utility software.

CIRCLE 846 ON READER SERVICE CARD



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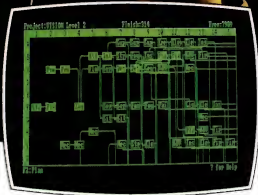
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CIRCLE 173 ON READER SERVICE CARD

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FROM INMAX

RAM-RESIDENT MACROS

If there's one thing every computer user wants, it's more speed. Witness the fascination with turbo boards, speedup chips, 386 processors, and supercomputers. But there's one problem no hardware innovation can solve: we generally interact with our computer system using the slowest input device available—the keyboard.

While your computer may be capable of processing tens of thousands of instructions every second, it spends most of its time waiting for occasional pokes at the keys, especially from those of us employing the two-finger method.

A number of software publishers offer help in the form of memory-resident keyboard enhancement software. These programs lurk in RAM waiting for particular keystrokes or keystroke sequences (say, Alt-F1). They then open up and pump your predefined string of up to thousands of characters into the application running, everything from plain old BASIC or DOS to your brand-new word processor. Such keyboard macro definitions allow even

*Keyboard macros can
turn complex operations
into one-stroke
commands, saving
keystrokes and
streamlining applications.
Seven packages
show you how. . .*

mediocre typists to increase productivity significantly.

The granddaddy of keyboard macro software was RoseSoft's *ProKey*, seen today in its fourth major revision. (Note: With Version 5.0 reportedly near release, RoseSoft declined to send *PC Magazine* its current product for review.) More recently, a number of other software vendors have gotten in on the act, each adding their own features to the basic product design.

Although features and capabilities vary from package to package, the common bonds here are keyboard macro definition—the ability to program a single key to respond with a multiple-keystroke response—and memory-resident operation. From these beginnings, each package goes its separate way.

The ability to hide away in the computer's random access memory is what allows these programs to work along with other applications running on the PC. When you run the macro program, it loads itself into the highest section of memory that's available and moves the high-memory pointer

FOR THE VIRTUOSO KEYBOARD

■ KEYBOARD MACROS



Keyboard Macro Programs: Summary of Features

(Products listed in ascending price order)

	Newkey FAR Software	SmartKey Software Research Technology	Metro Lotus Develop- ment Corp.	PrintKey Northwest Software Associates	Keyworks Alpha Software Corp.	SuperKey Borland International Inc.	Keyworks Advanced Alpha Software Corp.
List price	\$30.00	\$69.95	\$85.00	\$89.95	\$99.00	\$99.95	\$299.00
Memory required (RAM)	48K	37K	122K	22K	87K	64K	97K
Maximum macro size	32,000 keystrokes	Unlimited	16,000 bytes	128 bytes	20,000 bytes	64,000 bytes	Unlimited
Macro editor	●	●	●	●	●	●	●
DOS functions	○	●	●	○	●	○	●
Keystroke recording	●	●	●	●	●	●	●
On-line help	○	●	●	●	●	●	●
Extended key- board buffer	●	●	●	○	○	●	○
Cut-and-paste capability	●	●	●	○	●	●	●
Printer commands	○	●	●	●	●	○	●
Data encryption	○	●	○	○	●	●	●
Help menu/DOS shell creation	○	●	●	○	●	○	●
Other features	Fast key feature, shorthand mode	System clock, au- tomatic backup, disk security, key- board lock	Text editor, ap- pointment book, phone book (auto- dial)	Pause, delay, supports prefix characters	EMS support, shorthand macros	Keyboard lock, screen protection, redefinable key- board layout	Programming lan- guage interface, EMS support, shorthand macros
Known incompatibilities	Smartcom, XyWrite	Smartcom II, XyWrite II	Superkey, Sym- phony Link, Note-It	Leading Edge Word Process- ing, XyWrite II (and earlier)	Leading Edge Word Process- ing (Version 1.3 and earlier), Smartcom II, XyWrite III (and earlier), Samna Word III (and earlier)	Windows, Smartcom	Leading Edge Word Processing (Version 1.3 and earlier), Smartcom II, XyWrite III (and earlier), Samna Word III (and earlier)

Product Editor's Choice ● Yes ○ No

down. This prevents other programs from overwriting the memory-resident one. The macro program then continuously intercepts the activity of interrupt 9 (hexadecimal), waiting for a keystroke combination that wakes it up. When that combination occurs, the program responds by substituting the character string already defined for the keys pressed. One keystroke combination (such as Ctrl-Alt) is used by each program to halt the application currently running and bring itself to the foreground in a window opened up on the screen. From this window, a number of optional features, such as DOS commands or a text editor, appear in menu format.

After you've finished with the macro program, a key (often the Esc key) will erase the window, put the memory-resident program back in the shadows, and return to the original application.

Keyboard macro definitions can contain anything from a single stroke to thousands of characters. It's easy to see how useful large macros of often-repeated commands of text phrases can be, but the single-keystroke substitution can be equally useful. For example, you don't have to put up with IBM's practice of moving the Backslash and Esc keys around every time it revises its keyboards. With a macro program, you can put these keys where you

want them. Indeed, the entire keyboard can be remapped as a Dvorak-type layout if that's your bent.

FEATURES ARE THE KEY Competition constantly forces publishers to upgrade their products. As a result, keyboard macro programs now offer a wide array of macro features as well as auxiliary functions you used to have to buy other programs to get. In the macro creation area, keystroke "recording" is one particularly useful feature. While all of the programs have an editor for use in setting up macros, many now have the ability to record your keyboard entry and automatically capture

WORKING WITH MACROS

Macros are simply autopilots that take over control of your PC and handle the routine busywork that takes up so much of your day. Because a macro is another control system for your computer—which in itself can do nearly anything—you can use a macro to do nearly anything, too.

The simplest chore for the macro is merely repeating text strings. As such they can be quite efficient; one keystroke elicits dozens of others. For example, a lawyer might strike Alt-L and his macro will slide the word "litigation" into his word processor.

But that's just the beginning. If the lawyer has a library of boilerplate phrases he uses in contracts, writs, or wills the whole day long, he can turn them all into macros. As easy as typing Alt-A, Alt-B, Alt-C, he can create a contract, complete except for the names of his clients. Or a radiologist may use the same technique to make routine X-ray reports.

Likely candidates for text macros include your return address, commonly used but lengthy words and phrases ("notwithstanding," "the party of the first part"), and regularly used paragraphs ("In conclusion, this study indicates the need for more in-depth research and further investigation into this matter.")

Text typing is kid stuff for the latest breed of keyboard macros, however. With today's products, you can use a macro as you would a programming language to automate the most complex applications on your PC.

For instance, you can make a macro keystroke switch monitors or change

your screen colors from the DOS prompt. Another keystroke could run a series of programs. Your macros can help you overcome the deficiencies of your old favorite programs. For example, if you love *WordStar*, Version 3.3, you could set up a series of commands to mark your place in a text file you're editing by jabbing in a pair of asterisks, exiting your *WordStar*, running another program, then reentering *WordStar* and your file, finding the asterisks, and blowing them away—all with one keystroke.

Perhaps the most popular use takes the power of the macro even further, using it to gather data through a communications program, pull it into a spreadsheet or other data analysis tool, then print out the result.

For instance, pop your macro into its "learn" or "keystroke-saver" mode so that it will memorize your keystrokes. Then dial your favorite database to retrieve today's closing stock quotes. Hang up, call up 1-2-3 and pull in the numbers, graph them on the screen, and then print them out.

Tomorrow, just type Alt-0 (or whatever keystroke you elect) and your macro will repeat the whole process for you—one keystroke piling your in-basket with a stack of charts so that you can see at a glance whether the bottom has fallen out of your stock portfolio. If your macro program has a built-in time function, it can even automatically do the dialing at 2 A.M. and have your charts waiting for you the next morning.

—Winn L. Rosch

Winn L. Rosch is a contributing editor of PC Magazine.

ries or check filenames while using an application that doesn't offer these functions can be invaluable. An editor or notepad capability allows you to work on one document, quickly call up another, cut a piece of text from the second, and place it in the first. On-screen help has become a fact of life with most major PC software pro-

grams, and the keyboard enhancement packages follow suit. Such help replaces most trips to the bookshelf and searches through the manuals for the majority of simple questions.

Extending the size of the keyboard type-ahead buffer supported by DOS can be a considerable improvement. Where DOS allows only 15 characters to be entered before it beeps and quits, many keyboard enhancement programs extend this to 128. Other features may include telephone dialing (from an internal directory), alarm clock functions, calculators, appointment schedulers, help menu creation, printer commands, and data encryption.

There are a couple of points to consider when installing any type of memory-resident software on your computer: memory consumption and hardware and software

■ Keyboard macro programs now offer functions you used to have to buy other programs to get.

compatibility. Because memory-resident software is so wonderfully accessible from within other applications, there's a temptation to load the computer up with all that you can find. Do so and you might end up with insufficient free memory left to run all but the most trivial programs. Pick one or two that fit most of your needs and call it quits—640K bytes of memory isn't nearly as much as you think.

Also, stacking a number of RAM-resident programs indiscriminately in your computer can be an invitation to disaster. If more than one background program is designed to intercept the same keystroke sequence, the result might be a locked-up keyboard. Your only recourse might be to turn the system off and back on again. The document you just spent an hour editing will be lost for good.

Finally, RAM-resident programs have varying degrees of compatibility with PC clones. They all work with the IBM ROM BIOS, but may have problems with the imi-

it in a library of macros. This is often faster and a somewhat more natural process than entering a lot of less-common keypresses (such as control characters) from an editing environment.

Access to DOS functions from within another application should be considered mandatory. The ability to change direc-

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■ KEYBOARD MACROS

tators. Be prepared to argue your case with both the software publisher and the hardware manufacturer if it doesn't work.

Memory-resident keyboard macro software can be one of the best timesaving investments you can make for your PC—just exercise a bit of moderation when installing them on your system.

***** Keyworks

Alpha Software Corp. has released *Keyworks*, Version 3.0 (\$99), the third major revision to its macro software package. This latest incarnation of the well-appointed program adds shortcuts for defining macros and creating menus, an improved macro editor, support for the Lotus/Intel/Microsoft expanded memory specification and the latest IBM enhanced keyboards, an improved EGA driver, and more.

At first glance, the *Keyworks* manual looks a trifle cryptic. After a few minutes with it, however, you'll realize it was designed to encourage you to learn the program, rather than just present a mountain of keystroke examples. Sure, it begins with a fair number of keystroke sequences to get the novice started, but later it assumes you've learned a few things and don't want to be bombarded with the same old basic instructions. It's nice to see a software publisher that doesn't treat its customers like dillards.

TEXT EDITOR		INSERT
F=15	:Set the foreground color to color 15 (white)+	
B=0	:Set the background color to color 0 (black)+	
M=300	:Set the max number of macros in memory to 300+	
K=4000	:Set the max number of keystrokes in memory to 4000+	
T=60	:Set screen save delay in seconds (0 disables screen save)+	
S=2	:Set border style to 2+	
C=(F10)	:Set the Menu key to the F10 function key. For keys that+ :can be represented with a single keystroke, do not use { and+ :}+.	
D=20	:Set Menu delay to 20/100 seconds+	
P=M	:Specify that Keyworks should suppress prompting for + :Macro descriptions+	
A=H1	:Sets the video adapter card to Hercules in mode 1. For + :Hercules card in mode 2 set A to H2.+ :Reflex, Framework and SuperCalc3 use the Hercules card in+ :Mode 1. 1-2-3, Symphony and MicroSoft Word use Mode 2.+ :For an IBM Enhanced Graphics card set A to E.+ :To enable the Screen Save feature for an IBM Enhanced+ :Graphics card set A to E.+ :If you are using a regular color graphics or monochrome card,+	
F10Save	F5Quit	F2Cut F3Copy F4Insert F5Find F6Replace

With *Keyworks*, you can use either any pure-ASCII word processor to build macro files or *Keyworks'* own improved text editor. The editor assigns common editing operations, such as copy, insert, find, and replace, to the function keys and gives you full control over cursor movement.

The review sample came as an upgrade package for owners of the previous release (Version 2.0). The small manual is intended to supplement Version 2.0 by describing the new features offered in Version 3.0. A complete, single manual is bundled with new copies of *Keyworks* for first-time purchasers.

After *Keyworks* has been tucked away in RAM, its main menu can be brought to the foreground by pressing the keypad Plus key. If this conflicts with your applications, the program can be reconfigured to respond to another key or keystroke combination. Indeed, every key can be defined to respond with some character other than that on the keycap (just the ticket for Dvorak keyboard freaks).

The main menu offers a number of options, including macro recording, a few DOS functions, menu creation, and keystroke recall. *Keyworks* makes macro definition easier than some of the other packages by providing a decent macro editor. It has a full range of cursor movement control, moving by characters, words, lines, or pages, or to the beginning or end.


Equally useful is the ability to move, copy, or delete blocks of text within the macro file. Any word processor capable of generating pure ASCII files can also be used.

Keyworks is not only capable of moving a piece of text cut from an application to a macro, but it can also place it on a DOS file or send it out to the printer. The ability to cut a small table of figures from a spreadsheet in order to include a word processor document eliminates the need to rekey the data into the word processor (and so ends the likelihood of transcription errors).

RELIABLE ENCRYPTION *Keyworks* can be invoked from within any other application to perform most commonly used DOS functions—rename, copy, or erase files; create or remove subdirectories; change the selected drive or path; and format a disk. This latest version adds a Look command, analogous to the DOS TYPE command. The file encryption feature available within *Keyworks* is a lot friendlier than the one found in Borland's *SuperKey* product and a lot less likely to accident-



FACT FILE

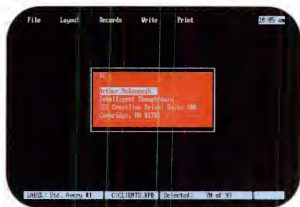


Keyworks, Version 3.0
Alpha Software Corp.
30 B St.
Burlington, MA 01803
(617) 229-2924
List Price: \$99
Requires: 120K RAM,
one floppy disk drive.

DOS 2.0 or later.
In Short: A very capable keyboard macro package offering such extras as menu and DOS shell creation, file encryption, an advanced macro editor, and the ability to execute DOS commands from within other applications. Not copy protected.

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■ KEYBOARD MACROS

tally destroy data files. It asks for a name for the new, encrypted file and then asks if you want the old one deleted from the disk. Answer yes and the old file will be removed from the disk in such a manner that it cannot be resurrected by file recovery programs such as *The Norton Utilities*. Furthermore, you cannot accidentally encrypt a file that has already been encrypted, or decrypt a file that was never encrypted to begin with.

Micro support people can make life a lot easier for novice PC users by using *Keyworks* to create customized menus and DOS shells. These allow the DOS neophyte to select a program from the list of choices of your design without having to know anything about changing directories or paths.

The operating parameters for *Keyworks* can be permanently changed by editing the KWCONFIG file, the one the program looks for when it is first started. Among the parameters you can change are the screen colors, memory allocation for macros, screen-blanking delay, type of video adapter (CGA, EGA, or Hercules), and use of a mouse.

Keyworks worked well with my usual software packages, but the manual states that programs that load at absolute memory addresses or that tinker with keyboard interrupts can cause problems. Those known to be incompatible include early versions of word processors from Leading Edge Software Products, Samna Corp., and XyQuest, and the *Smartcom II* communications program. (For version numbers, see the features table.)

Keyworks offers a broad range of functional power and should be seriously considered for your macro software needs.

Keyworks Advanced

Keyworks is certainly a fine keyboard macro program, one eminently well suited to the needs of most PC owners. Alpha Software Corp., however, saw the opportunity to offer yet another product, *Keyworks Advanced*, for the person setting up a PC application for the novice user—or the dyed-in-the-wool power user. It all depends on just how you look at it.

Keyworks Advanced, \$299, offers a



The *Keyworks Advanced* macro editor displaying a DOS shell (the macro language commands have been highlighted in reverse). The syntax checker is a new addition to this function.

whole flotilla of extra features, including a complete macro programming language, printer control, user-defined help screens for any application, a programming language interface, disk-space-limited macro size, and much more.

This product is not for the first-time macro software user, but rather for one with enough experience (particularly with the standard version of *Keyworks*) to put its formidable power to use. The most impressive aspect of this package has to be the *Keyworks* Programming Language (KPL). With it, you will discover the ability to capture screen information from within any application (allowing you to program custom-made context-sensitive help screens), perform conditional logic tests, define variables, jump to macro subroutines or branch to other macros, alter macro program flow with a "case" conditional, and execute "loop" commands until a particular logical condition is met.

Sure, you can write your own programs in BASIC or Pascal to do such things, but they will work with only that program, not your word processor or spreadsheet. Dedicated programming languages have long been part of many database packages and, more recently, some communications pro-

grams. KPL has the distinction of being the first such rendition of a programming language specifically intended for keyboard macro software.

Every other keyboard macro program reviewed here sets aside a buffer in memory for storage of macro definitions. To a certain extent, this limitation can be over-

PC FACT FILE



Keyworks Advanced
Alpha Software Corp.
30 B St.
Burlington, MA 01803
(617) 229-2924
List Price: \$299
Requires: 128K RAM,
one floppy disk drive,

DOS 2.0 or later.

In Short: Much more than a mere keyboard macro package, it is nothing short of a complete programming environment. *Keyworks Advanced* can be used to design help screens, data entry forms, and more, for just about any application. You get what you pay for, and in this case you pay a lot. Not copy protected.

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Hercules 720x348 graphics is the highest popularly supported resolution available for IBM PCs/XTs/ATs, and a wealth of compatibles.

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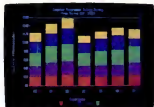
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Which brings us to yet another big benefit for spreadsheets and graphics. Hercules cards are completely compatible with each other.

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Hercules

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WORDPERFECT MACROS: THE NAME GAME

If you can press Ctrl-F10 and type your name, you know how to write a *WordPerfect* macro.

WordPerfect's macros can use all the program's functions, including sorting, math, and merge. Macros can address letters and print envelopes, reformat files for electronic mail, extract text from one file to another, scroll through one window while you work in another, and even turn *WordPerfect* into a small-scale accounting package.

To write a macro, press Ctrl-F10, give the macro a name, type the keystrokes you want the macro to record, and press Ctrl-F10 again when you're done.

Your name macros in different ways depending on how you use them. The ones you use often can be named with an Alt-letter combination and invoked simply by typing that combination again. Other macros have names of two to eight letters and are invoked by pressing Alt-F10 and entering the name. Macros used only in the current session can have one-letter names *or, for something really quick and dirty, no name at all—simply press Enter when prompted to name the macro or invoke it.*

Macros you use with all your files be-

long in the directory in which you keep *WordPerfect*. To use different sets of macros with different groups of files, put each set of macros in the directory that includes its related files. This trick lets a playwright use an Alt-O macro to type out the name "Othello" while working in his \OTHELLO directory, yet use the same Alt-O keystroke to type out "Ophelia" while working in his \HAMLET directory.

Many features you won't find in *WordPerfect* itself can be conveniently added through macros. For instance, you can't use the program's Replace function to replace certain format codes, but you can write a macro that will search for the function, delete it, and then enter the new function.

WordPerfect's macros normally work invisibly, so you see the result on-screen only when the macro is finished. If you want to see the macro in action, you can press Ctrl-PgUp after you start defining the macro and enter a number that determines how fast the keystrokes fly by on-screen. If you want the macro to prompt you for keyboard input, simply press Ctrl-PgUp followed by two presses of the Enter key at the point where you want to be prompted.

After you write a few dozen macros, you'll begin to forget what they do. With the Macro Editor that comes with the *WordPerfect Library*, you can add comments to the macros and read these comments from *WordPerfect's* directory screen. The Macro Editor also lets you debug and rewrite existing macros. If you use the *Library* package, you can even write macros to transfer data from *WordPerfect* to other programs.

The cleverest way to use macros is to put them in a chain gang. A simple chain consists of a macro that invokes a second macro at the end. A conditional consists of a Search macro that includes within it a Not-Found macro and a Found macro. The Search macro looks for a string or code and executes the Found macro when it finds it. When the Search macro doesn't find the string or code, it executes the Not-Found macro. You have to put the Not-Found macro at the start of the Search macro, even though it seems intuitive to put it at the end. The best test of a book on *WordPerfect* is how clearly it explains this essential detail.

—Edward Mendelson

Edward Mendelson is a frequent contributor to PC Magazine.

come by allowing you to call up any single macro file previously defined. Still, you can work with only one file at a time, and one no larger than the buffer set aside (10K bytes in the case of *Keyworks*, Version 3.0). *Keyworks Advanced*, on the other hand, allows macros to be called in from externalized disk files, much as a mini-computer operating system (like VAX/VMS) pages disk files in and out of memory as needed. In this manner, macro files are limited in size only by the amount of available disk space. Because all of these external macro files are stored in parsed (that is, executable) form, access speed from a hard disk is almost as fast as if they were stored in RAM, and a hard disk should be considered a must for their optimum use.

SLIDE SHOW KPL has several commands for capturing screen images and later playing them back as "slides." These images may be stored either as internal (buffered) macros or in compressed form in a disk file. As such, *Keyworks Advanced* could be the perfect application for developing computer-aided instruction programs.

Printer control is another forte of *Keyworks Advanced*. Although most word processors have features that allow portions of text to appear as boldface, italic, underlined text, and so on, many other applications (spreadsheets, databases, and the like) do not. A print control macro embedded in a spreadsheet, for example, can display column totals in boldface type. The RAM-resident portion of *Keyworks*

Advanced intercepts the output to the printer, and when an embedded macro code is found, it will send the appropriate sequence to the printer to enable the mode selected.

The Applications Program Interface (API) allows specially written programs (that is, your own assembler routines) to execute macro routines without pressing that macro's identification key sequence. The API is invoked through the use of interruption 6B (hex), with the desired function number placed in the AX register by the host program. Upon return to the application, the CL register will contain the appropriate completion code.

Keyworks Advanced is a brand-new product, and its documentation was not final when this review was written. Howev-

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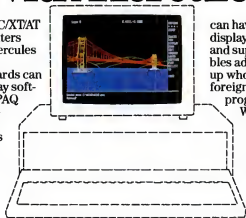
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■ KEYBOARD MACROS

er, the preliminary manual appeared to be right on target. The emphasis is strongly on KPL, with detailed explanations of all of the language's commands.

As you might expect, the power of *Keyworks Advanced* has its price. Besides its \$299 price tag—roughly three times what most other macro programs cost—the program will punch a 128K-byte hole in the computer's memory. Systems with less than 640K bytes of RAM may not be able to run some of the larger software packages after loading the resident portion of *Keyworks Advanced*.

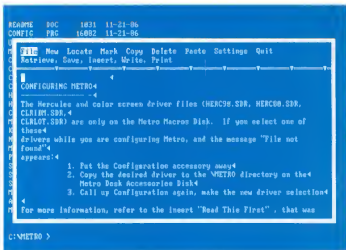
In addition, you need to learn a programming language (KPL) to put all of this power to use. *Keyworks Advanced* is certainly the most powerful keyboard macro package of those reviewed here, but that doesn't make it right for everyone. For those willing to learn the programming language either for their own benefit or, more likely, to set a system up for someone else, this is the package to choose. If you just want a macro program to enhance the capabilities of your existing applications and know nothing of programming (or don't care to learn), look elsewhere.

Metro

Only one package in a multiple-product review can be The Big Ticket item, and Lotus Development Corp.'s *Metro*, \$85, falls handily into that category here. In this instance, "big" refers not only to memory consumption, but also to documentation and features. *Metro* is both a macro facility and a desktop accessory—the kind of product you might get by combining *SideKick* and *SuperKey*.

The biggest fans of *Metro* would not doubt be those who live and breathe 1-2-3, since the product is designed to give 1-2-3 users access to other tools without leaving the Lotus environment. Everything about *Metro*—from the familiar screen design to compatibility to examples in the manual—shouts 1-2-3.

Metro carves (by default) 122K bytes for itself in your system's memory, but that's only a fraction of the total size of the package. Unlike many other memory-resident programs that are entirely contained in RAM, *Metro* loads a "kernel" program



Metro's text editor in operation. The moving bar will be familiar to 1-2-3 users.

that calls in additional accessory overlays as they are needed. If you don't need the ability to call all of *Metro*'s features into play at the same time, the program's flexible memory-management system allows the stay-resident kernel portion of the package to be reduced in size.

Keyboard macro definition is the main purpose of all of these software packages, and *Metro* certainly shines as a macro program. It gives you macro capabilities that can be used in any program, not just packages that have their own macro mode built in. There are two ways to set up macros with *Metro*: they can be entered from the keyboard using an automatic "recording" mode, or they can be programmed using a text editor (one is included for that and other purposes).

The macro facility is a programming language in itself, complete with variables, subroutines, logical arguments, timing delays, and pauses for keyboard input. The basic style of the macro definitions will be instantly recognizable to anyone who has ever defined macros within 1-2-3.

MACROS AND MORE Now for the fun part—macros may be the biggest single function provided by *Metro*, but they're far from the only one. The package's other

functions, which Lotus calls "desk accessories," just might have you putting *SideKick* back on the dust-and-cobweb shelf. It effectively replaces most of the features of *SideKick* along with a few other utilities as well. For openers, there are no less than three text-oriented utilities provided: the notepad, the clipboard, and the editor. The notepad serves as the electronic equivalent of those ubiquitous little yellow Post-its. It merely records your keystrokes to the disk or printer and is limited in size to 8 pages,

EDITOR'S CHOICE



FACT FILE



Metro, Version 1.0
 Lotus Development Corp.
 55 Cambridge Pkwy.
 Cambridge, MA 02142
 (800) 882-4432
List Price: \$85
Requires: 122K RAM,
 one floppy disk drive, DOS 2.0 or later.

In Short: A powerful keyboard macro package that offers the features of a number of other RAM-resident programs as well. The emphasis is clearly on functionality with other Lotus applications. Not copy protected.

CIRCLE 666 ON READER SERVICE CARD

Networks Love Hercules.

Mono to Color Compatibility Make Driver Worries a Thing of the Past.

If you're trying to tie together your IBM compatible PCs, you don't need us to tell you about the hassles of different kinds of color and monochrome monitors and graphic cards requiring different video drivers for different software spread throughout your network.



A single unified driver runs many programs in monochrome...



...and in full color on different PC/monitor combinations.



Hercules can make your life a bit easier. And while we're at it, improve the way your software runs. Our suggestion:

You've probably already standardized on Hercules cards for your *monochrome* PCs. We suggest you also standardize on Hercules for your *enhanced* color systems.

Good-bye Driver Worries.

Our new InColor Card is fully compatible with Hercules monochrome cards. This means it will run every one of the thousands of programs written for those cards in two colors, using the standard monochrome driver included with the software.

And most popular programs... like 1-2-3, Symphony, Framework, AutoCAD, and many others use a single driver to run in full color (up to 16 colors selected from a palette of 64) on our InColor Card, and in mono on our monochrome cards.

What it all adds up to is this: If you've standardized on Hercules, a single driver

installed with the program at the file server will work with both your mono and color PCs. And that's one less thing to worry about.

We Run Software Better.

That great compatibility and unified driver concept is just one of the ways we improve the way software runs, on or off a network.

Your software also benefits from Hercules' crisp 720x348 resolution—the highest popularly supported standard in monochrome or full color.

And Hercules exclusive RamFont mode improves the performance of spreadsheets and word processors (1-2-3, Symphony, Framework, Word, Manuscript, and many others) by letting them display up to 3,072 software definable characters instead of the fixed 256 ASCII character set.

So, to get the most from your software and your network, specify the Hercules Graphics Card Plus, or the Hercules InColor Card for your systems. Your network will love you for it.



Hercules Graphics Card Plus

(For monochrome monitors)
Includes the three modes your software needs most.

- Standard Text—For thousands of text-based programs
- Hercules 720x348 graphics—highest popularity supported standard
- Hercules RamFont—3,072 software definable characters improve many popular software programs. (Call for the latest list.)



Hercules InColor Card

(For multi-sync and enhanced color "EGA-type" monitors.)

Runs all Hercules monochrome software in 2 colors, most popular software in up to 16 colors selected from a palette of 64.

- Standard Text—All programs run in 2 or more colors.
- Hercules 720x348 graphics in up to 16 colors—15% higher resolution than EGA.
- Hercules RamFont—3,072 software definable characters in 16 colors up to 12,288 in 2 colors.

For more information call Hercules toll-free at: 1-800-532-0600 Ext. 302. In Canada, 1-800-323-0601 Ext. 302.

Hercules

We run your software better.

1-2-3 MACROS: EASY AS YOU-KNOW-WHAT

Macros are the key to getting the most out of Lotus's 1-2-3. They can be as simple or as complex as you care to make them, but they all share the same purpose: to make your life easier.

There are essentially two kinds of 1-2-3 macros. The first lets you "automate" keystrokes, so that by hitting just two keys you can get the effect of hitting many keys. These are great timesavers. The second kind uses special macro keywords to do things that can't be done just by hitting keys. At this level, 1-2-3 macros begin to look and act like real computer programs.

Let's write a simple keystroke macro. Imagine you are building a spreadsheet with many parts, and each part is titled Regional Activity Report. Each title should be in a separate column with a width of 20 characters. You could go to each column, reset its width, and enter the title, but that's a lot of keystrokes. With a macro you can do the job with two keys.

To build the macro, enter two labels in a blank spreadsheet so that it looks like Figure 1. The label in B3 is the script of the macro, that is, a representation of the keystrokes you want it to carry out. The label in A3 is the range name of the cell with the macro script. You'll have to start both labels with an apostrophe (') to get a normal label display.

The macro script is, with one exception, composed of the very same keystrokes you would use at the keyboard. Where you would have hit Enter, you enter a tilde (~) instead, which is the macro symbol for an Enter.

Now with the cursor on A3, use the

	A	B	C	D	E	F
1						
2						
3	\W	/wcs20"Regional Activity Report"				
4						
5						
6						
7						

Figure 1: A simple keystroke-saving macro.

\G	{getnumber "Enter a number between five and eight: ",NUM}
TEST	{if NUM=5{bsep 1}{bsep 2}{branch WRONG}
	{if NUM=6{bsep 1}{bsep 2}{bsep 3}
	{if NUM=6}{pgdn}{wait @now+time(0,0,4)}{pgup}
	{if NUM=7}/ws
	{if NUM=8}{hscrl}/wch.(right 2)"}
WRONG	{getnumber "Between five and eight, please: ",NUM}{branch TEST}
NUM	6

Figure 2: A more complex macro that branches according to user output.

/Range Name Label Right <Enter> command to give cell B3 the range name \W. It's a special kind of range name that identifies the script in B3 as a macro. If you now hold down the Alt key and hit W, the macro will set the column width and enter the title a whole lot faster than you could. Move the cursor and run the macro again. It works every time.

If Figure 1 whetted your appetite, Figure 2 contains a more advanced macro that runs with Alt-G. It first asks you to enter a number from the keyboard and then does different things depending on the number you give it. After you have typed it in, be sure to use the /Range Name Label Right command to give the range names like \G and WRONG to the cells in your right.

These handy shortcuts don't even be-

gin to scratch the surface of what you can do with macros. The 1-2-3 manual describes all the different elements you can include in macro script, but there's no limit to the ways you can put them together. You can write macros to automate any 1-2-3 routine. You can even use them to build custom menus and write full-scale applications for accounting, say, or stock portfolio management.

How deeply you want to get into macros is up to you. Some people write a macro once a year, while others make a living writing them. Either way, they'll help you harness the full power of 1-2-3.

—Jared Taylor

Jared Taylor is the West Coast editor of PC Magazine and editor of Spreadsheet Clinic.

each containing no more than 14 lines of 40-character-wide text.

If you need a bit more space for your thoughts, the editor should come in handy. Here you are limited in size to the available free memory on your computer, as the entire document must be loaded into RAM. While not a true word processor, the editor

does have such capabilities as cut-and-paste, file merging, printing, word wrap, and a broad assortment of cursor movements. The clipboard serves as a buffer area for moving text from one Metro accessory to another or to and from an applications program. For example, a simple spreadsheet table can be cut from that ap-

plication, moved to the clipboard, and inserted into a document file. Although a few recent high-end word processors offer this ability, Metro allows the same function with your old applications (and keeps you from having to learn yet another set of instructions).

The List Manager accessory might just

Our new desktop manager is more than you bargained for.

No matter how you define "desktop accessory products," Metro™ rewrites the category.

PC World calls it "the most comprehensive assemblage of desktop accessories to date." And Info World says simply, "At \$85, it qualifies as one of the year's best bargains."

The all-things-are-possible program.

But what is Metro? And what will it do for you?

According to PC Magazine, it's an unprotected, "all-things-are-possible terminate-and-stay resident (TSR) program that can potentially replace most, if not all, of the TSRs you customarily use."

A powerful macro function and 12 ambitious accessories.

Quite a mouthful. But, then again, quite a product. Metro combines a powerful macro processor with 12 other accessories. Of the macro function, Info World writes, "... (it) goes further than similar products and provides the elements of a simple programming language."

"In a word," continues PC Magazine, "excellent."

Of the 12 other accessories, Info World noted "... we expected a few of them to be of limited usefulness or poorly implemented. We did not find this to be true."

These accessories include:

- The filer, which organizes data and program files, and performs DOS functions.
- The editor, which allows you to write memos, letters, and reports without leaving Lotus 1-2-3® or Symphony®.
- The phone book, which dials your phone and produces mailing labels.
- The clipboard, which moves data from one Metro accessory to another, and transfers data from one application program to another.
- The list manager, which maintains to-do lists, and tracks tasks and projects.
- The watch, with alarm, which times up to 100 individual tasks.
- The calculator, with exponential display, which performs arithmetic and financial calculations.
- The notepad, which records ideas, memoranda, and notes.
- The appointment book, with audible alarm, which maintains daily, weekly and monthly calendars.
- The kaleidoscope, which customizes the accessory display for color monitors.
- The configuration, which manages the memory allocation of Metro and customizes its functionality.
- And the special characters, which serve as a reference for ASCII characters.



A real solution to RAM-Cram.

What makes Metro more functional than any comparable product is that all 12 of its accessories need not be in memory at the same time. Once the Metro kernel is loaded, you may call up any or all of the 12 accessories, customizing your own program. In the words of P.C. Letter, "Metro offers a comprehensive, essentially bullet-proof, single vendor alternative" to using other, incompatible accessories. And you can unload it from memory with a single keystroke.

"What's most attractive about Metro," continues P.C. Letter, "is that you don't have to worry about its accessories killing each other or the application" you're using. Metro essentially provides "that long awaited, much debated solution to what's fondly known as RAM-Cram."

An ever-expanding environment.

Metro saves you time. Makes you more efficient. And accepts standard Lotus® commands. What's more, it provides an ever growing environment that will make it "even more

far-reaching and powerful" (PC Magazine).

\$85 and available now.

Amid all this praise, there must be a problem, you think. Perhaps it's difficult to use? Not so, says Info World. "We had Metro up and running 20 minutes after tearing off the shrink wrap."

Now you can, too. For only \$85, you can have Metro, the software PC Magazine has "vying for honors as the king of the TSR programs." Unprotected, customizable, sure to save you time and trouble, Metro is the management tool you've been longing for.

So visit your authorized Lotus dealer. Or call 1-800-345-1043 today. Ask for product no. QT-1690. (For more information, ask for QT-2821.) Order your copy of Metro now. For only \$85, you'll be getting more than you bargained for.

Lotus Metro

The memory-resident desktop manager combining twelve accessories and a powerful macros program.

System Requirements: Lotus Metro runs on IBM® PC/XT/Portable PC, Portable AT®, COMPAQ PORTABLE®, COMPAQ PLUS®, COMPAQ DESKPRO®, and 286 double-sided disk drives (hard disk recommended for optimal performance). Minimum of 80K required for RAM resident kernel of Metro. DOS 2.0 or higher. Metro is unprotected and can be removed from memory. Lotus Metro runs with a wide variety of software programs including 1-2-3®, Symphony®, Symphony Spelling Checker, Symphony Test Outliner, 3-2-1 Report Writer®, and Signal®.

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Lotus, 1-2-3 and Symphony are registered trademarks, and 1-2-3 Report Writer, Signal and Metro are trademarks of Lotus Development Corporation.

■ KEYBOARD MACROS

replace whatever outline processor you are using (or introduce you to that capability of your PC). You can enter project tasks in a free-form manner and then sort them by date, name, task, or whatever you like. If all this still isn't enough, there's also a phone book (with auto-dialing if your modem supports it), a DOS shell, a financial calculator, a 128-character type-ahead buffer, a stopwatch (with up to 100 timers), an ASCII character chart, and a program for customizing the display colors.

Metro's documentation is by far the most polished of the bunch. Not surprisingly, many of the examples contained in the manual are directed at 1-2-3 and Symphony users. A separate, smaller quick-reference guide shows only such things as the horizontal menu bars and function keys for each accessory. This might be a handy thing to have, but it won't do you a bit of good in learning macro programming from scratch.

Metro may have a compatibility problem with non-Lotus applications. Loading *Metro* along with *SuperKey* (an admittedly weird combination) caused every keystroke to be echoed twice to the screen. This phenomenon could not be duplicated using *SuperKey* with any of the other packages. Inasmuch as *Metro* may be the only memory-resident program you need, this might not be an issue.

If you have 1-2-3, you need *Metro*; if you don't, check it out anyway.

.....

Newkey

FAB Software (named after company president Frank A. Bell) began marketing *Newkey* as a shareware (try it first, then pay for it) product 3 years ago. This increasingly common marketing technique has given us a number of surprisingly good software packages (*ProComm*, *PC-Talk*, *PC-Write*) at bargain-basement prices.

The only differences between the purchased version and the shareware copy of *Newkey* are the introductory screen and the printed manual provided to registered users. If you have any interest in the product, send FAB Software \$30 and get the complete package—the latest version on disk and the printed manual—and help keep the shareware concept alive.



Newkey's parameter screen lets you set up the program to work with your PC system.

Newkey doesn't have the level of polish provided by its more-expensive peers, but that really doesn't seem to matter. It works, and it will probably provide all of the keyboard macro power the average PC owner is likely to need. Missing are the seemingly obligatory pull-down menus and context-sensitive help screens found in many of the other programs. To get you off on the right foot, however, FAB has included a demo program and a number of sample macros for popular programs, such as 1-2-3 and *WordStar*.

The biggest improvement in this latest version is a full-screen macro editor. Not only are there a variety of cursor-movement controls, but other macros can be called in and the keyboard buffer captured from within the editor. If you feel more comfortable using an editor you already know, any word processor capable of editing straight ASCII files can also be used. Also new is a shorthand mode that monitors the keyboard input for the names of multicharacter macros. When enough characters have been entered to differentiate the name from any others, the entire macro name is substituted instead. For example, if you have a macro designated as "flintwood," and it is the only one that be-

gins with the letters "fli," then "fli" is all that would have to be entered.

At 57K bytes of RAM usage, *Newkey* is one of the leanest programs reviewed here. For those with very restrictive memory requirements, a second, smaller version of the program is included (NEWKEYSM).

EDITOR'S CHOICE



NEWKEY
User's Guide

FACT FILE



FAB Software

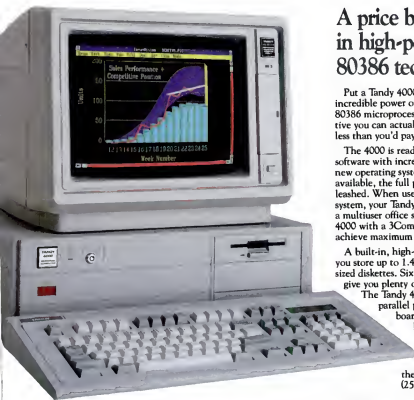
Newkey, Version 4.0
 FAB Software
 P.O. Box 336
 Wayland, MA 01778
 (617) 358-6357
 List Price: \$30
 Requires: 57K RAM
 (33K for small module),
 one floppy disk drive, DOS 2.0 or later.

In Short: A shareware keyboard macro package that gives some of the retail-only products a run for their (much more) money. The new full-screen macro editor takes *Newkey* out of the "hackers-only" domain and places it right up with the very best. Possible compatibility problems can be judged first through the shareware distribution system before laying out a trivial \$30. Not copy protected.

CIRCLE 844 ON READER SERVICE CARD

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A price breakthrough in high-performance 80386 technology.

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The 4000 is ready to run current PC and AT® software with incredible new speed. And when new operating systems such as OS/2™ become available, the full potential of 80386 can be unleashed. When used with the XENIX® operating system, your Tandy 4000 can become the heart of a multiuser office system. Or configure the Tandy 4000 with a 3Com® workgroup file server to achieve maximum productivity.

A built-in, high-capacity 3 1/2" disk drive lets you store up to 1.4 million characters on pocket-sized diskettes. Six AT slots and two XT™ slots give you plenty of room for system expansion.

The Tandy 4000 also comes with serial and parallel ports, a 101-key enhanced keyboard, and a keylock with chassis-lock mechanism for system protection.

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Company

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ZIP

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Price applies at Radio Shack Computer Centers and participating stores and dealers. Monitor, display adapter and operating systems sold separately. AT/Reg. TM and XT/IBM IBM, XENIX/Reg. TM and OS/2/Reg. TM Microsoft Corp. 3Com/Reg. TM 3Com Corp.

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CIRCLE 289 ON READER SERVICE CARD

■ KEYBOARD MACROS

that reduces memory consumption to only 33K bytes. With the smaller version, however, you lose the main option menu and access to the macro editor from within another application. A support program is included, though, that allows the smaller version access to the functions of the full-blown version from the DOS command line. In addition, it can be used to execute macro functions from DOS batch files.

The manual supplied with *Newkey* is surprisingly complete and well written (remember, this whole deal sells for only 30 bucks). It would benefit from sample screens, however. Other features thrown in to round out the package include a screen-saving routine that blanks the video output after 5 minutes of inactivity; the ability to cut text from one application, save it in a macro, and later paste it into another application; variable timing delays; and a 128-character keyboard buffer.

The only thing that keeps *Newkey* from being the runaway winner here is compatibility. Other programs that call upon the same hooked vectors tend to render *New-*

■ *Newkey's* really excellent. Better yet, it gives you the opportunity to try it before paying for it.

key almost useless. The worst offenders seem to be *Smartcom* and *XYWrite*. Some, such as *PC-Write* and *WordPerfect*, have minor problems, but these can be worked around by careful selection of options. Certain PC clones may also have problems with *Newkey*. The PC's Limited AT (and others using the AMI ROM BIOS chips) has a set of built-in diagnostic utilities brought up by pressing Ctrl-Alt-Enter. When *Newkey* is resident, these routines are disabled, and the only recourse is to remove *Newkey* from memory (using an option under *Newkey's* support program).

Don't be put off by these minor problems with *Newkey*—it's really an excellent keyboard enhancement program, and one that deserves serious consideration. At

only \$30, give it a shot. Better yet, try to get an evaluation copy from a bulletin board or PC user group member and try it. *Newkey* may be all you need, and no other package here gives you the opportunity to try it before paying for it.

PrintKey

All of the other macro software programs reviewed here have jack-of-all-trades pretensions, but *PrintKey* (\$89.95) has just one purpose—to help get the most out of that feature-laden printer sitting next to your PC. Just about every dot matrix and laser printer available has a number of type styles beyond the usual pica format, including condensed, italic, boldface, and so on. Getting these features to work with existing software, however, can range from a major headache to downright impossible. *PrintKey* fixes all that by allowing you to embed macro codes containing printer control sequences into files created with your existing software. As the document is printed, these macros will automatically be replaced by the appropriate control sequence to activate the desired printer feature.

NorthWest Software Associates bills *PrintKey* as a universal printer driver—a



FACT FILE



PrintKey, Version 1.1
NorthWest Software
Associates
12469 E. Olive
Spokane, WA 99216
(800) 422-6972
List Price: \$89.95
Requires: 22K RAM,
one floppy disk drive, DOS 2.0 or later.

In Short: A special-purpose macro program that helps make short work of enabling your printer's special features with documents created using most any software. Not copy protected.

CIRCLE 63 ON READER SERVICE CARD

lofty claim, but one it lives up to well. A driver's disk included with the package has predefined macro files for over 260 printers, and the number keeps growing. *PrintKey's* macros can contain up to 128 characters, and more than one printer parameter can be contained in the same macro. One macro, then, could be defined to enable both italic and underline mode with a single macro call. The macros are stored in separate files, each capable of holding 64 macros. The number of macro files is limited only by disk space.

Current PrintKey Data					
File: rx88p	Relay Char: \N	Format Char: \✓			
Port: LPT1	Relay Time: 15 second(s)	Print In Char: \			
Menu: ScrLk					
Key	Char	Macro Name	Key	Char	Macro Name
A L	NL	LINEFEED	A P	NF	FORMFEED
A G	N6	6 LPI	A S	NB	8 LPI
A 9	N8	10 LPI	A I	N1	10 CPI
A 2	N2	12 CPI	A W	NW	EXPAND ON
A S W	Nw	EXPAND OFF	A C	NC	COMPRESS ON
A S C	Nc	COMPRESS OFF	A E	NE	EMPHASIZE ON
A S E	Ne	EMPHASIZE OFF	A B	NB	BOLD ON
A S B	Nb	BOLD OFF	A I	N1	SUPERSCRIFT ON
A S I	N1	SUPERSCRIFT OFF	A J	NJ	SUBSCRIPT ON
A S J	Nj	SUBSCRIPT OFF	A U	NU	UNDERLINE ON
A S U	Nu	UNDERLINE OFF	A I	N1	ITALICS ON
A S I	N1	ITALICS OFF	A B	NB	UNIDIRECTIONAL
A S B	Nb	BIDIRECTIONAL	A Q	NQ	QUIET MODE ON
A S Q	Nq	QUIET MODE OFF	A O	NO	CSP ENABLE
A S O	No	CSP DISABLE	A A	NA	PRINTER RESET
A P	Np	PROPORTIONAL ON	A S P	Np	PROPORTIONAL OFF
Space = more Macros			Menu Key = exit		

PrintKey comes with several preset macros for popular printers, including the Epson RX-80.

Macros are added, removed, and changed within each macro file using PKEdit, a menu-driven editor included as part of the package. Using PKEdit is largely self-explanatory, which is a good thing, because it's not explained all that well in the manual. While *PrintKey* is generally run as a background task during the printing of files with embedded macros, it can also be called to the foreground for immediate control of the printer, such as pausing output.

A printer spooling program included with *PrintKey* allows a buffer to be set up in memory for temporary storage of data going out to the printer, thereby allowing the computer to be used immediately rather than having it bogged down by the printer. The size of the buffer can be set from 16K to 64K bytes, with 64K being the default value. LPT1 is the only printer port supported by the spooler.

PrintKey is fully compatible with a number of other memory-resident programs, including Borland's *SideKick* and *SuperKey*. A document file on the disk

PrintKey won't solve all of your printing woes, but it goes a long way toward enabling printer features that would otherwise be unavailable from many other applications on your software shelf.

SmartKey

Software Research Technologies' *SmartKey* seems to have been around forever, but like few other products, age and evolution are an advantage here rather than a detriment. Rather than resting on its laurels, SRT has been busy incorporating a number of new features into its major product, now in Version 5.2.

The usual keyboard enhancements provided by macro software are all here—the ability to define single keystrokes that insert whopping amounts of text into your database, spreadsheet, or any other application. In fact, up to 60,000 characters can be called up by pressing a single key.

SmartKey functions are addressed through a series of horizontal menu bars somewhat reminiscent of 1-2-3. As with that product, you use the cursor keys to move among a group of functions listed on a single line. As you do so, a one-line ex-



FACT FILE



SmartKey, Version 5.2
Software Research Technologies Inc.
2130 S. Vermont Ave.
Los Angeles, CA 90007
(213) 737-7663
List Price: \$69.95
Requires: 50K RAM
(3K for SmartPrint), one floppy disk drive, DOS 2.0 or later.

In Short: An excellent all-around keyboard macro package that includes a printer enhancement program (*SmartPrint*) at no extra charge. Not copy protected.

CIRCLE 852 ON READER SERVICE CARD

planation of each function appears immediately below. All keyboard macro software programs allow certain key combinations (like Alt-I or Ctrl-A) to perform some function not supported by the application running in the foreground. *SmartKey* goes one better by allowing one key (by default, the keypad Minus key) to act as another Shift key. SRT refers to this key as the Supershift key, and when combined with another keystroke, it increases

■ *PrintKey* has just one purpose—to help get the most out of that feature-laden printer sitting next to your PC.

show the correct order in which to load these programs to preserve harmony among them. One minor problem arises because of the way macros are interpreted when a document is printed. Each inserted macro code is preceded by a prefix key (by default, the Backslash), and when a document is printed, the prefix key and the one immediately to its right (the macro definition itself) will be stripped from the printer output, whether or not the macro definition is valid. If the document needs to display the prefix key as an actual part of the text (say, when writing about DOS path commands), it will have to be changed to some otherwise unused key.

SmartKey 5.2i	File: wordstar	Smart: [K+]	SS: [K-]	19483 Free					
System:	mdir	Directory	Erase	Format	Move	copy	Rename	Type	WhereIs
Change or display the current directory for any drive									
2	118.000	Washington	Eastern	288.000	\$295,000.00				
3	210.000	Chicago	Midwest	000.000	\$585,000.00				
4	228.000	Dallas	Midwest	000.000	\$524,000.00				
5	381.000	Denver	Western	1000.000	\$185,000.00				
6	382.000	Los Angeles	Western	100.000	\$637,000.00				
7									
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11									
12									
13									
14									
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One of the main advantages of memory-resident macro packages is their accessibility from within applications software. Here *SmartKey* is called up during a 1-2-3 session.

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EPSON Ex-200 P2-2800	9-Dot Matrix	240/ 48	Draft/ NLQ	8	80 136	Standard Parallel with "Dual Identity" Dip Switch
LQ-800 LQ-1000	24-Dot Matrix	180/ 60	Draft/ LQ	7K/ 1K	80 136	Parallel (Centronics Compatible) or Optional Serial (RS-232C)
NEC P200 P700	24-Dot Matrix	216/ 66	Draft/ LQ	8	80 136	Parallel (Serial Models are available)
DICOMIX 150-P	12 Thermal Ink Jets	150/50	Draft/ LQ	1	7 1/8" Print Line	Centronics (Optional RS-232C)
TOSHIBA P2215L P2415L P2515	24-Dot Matrix	216/ 32 300/100	Draft/ LQ	32 4	80 136	Parallel/Serial Standard Centronics Parallel w/RS-232C Serial

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P660 (not shown) List Price \$699 Our Price \$479

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P321SL**



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P341SL (not shown) List Price \$699 Our Price \$479

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■ KEYBOARD MACROS

the number of macro definitions possible.

One area in which *SmartKey* seems to have an edge on its competitors is compatibility. I couldn't get it to misbehave with any of a wide variety of applications, but the manual cites a few that are known to be incompatible, mainly *Smartcom II*, *Xy-Write II*, and *Samna Word*—programs with which no RAM-resident programs appear to be amenable.

OMNISCIENT OMNIKEY The most intriguing feature in this latest version of *SmartKey* has to be *OmniKey*. Not a conventional macro key definition, *OmniKey* lies dormant in memory until a certain condition is met. It is then executed automatically without any intervention on your part. One possible use is as an alarm clock. Defined to act at a preset time, the *OmniKey* will continuously monitor the system clock, and when the time comes, it will pop a message onto the screen. Of more use, perhaps, is *OmniKey*'s ability to make automatic backups of whatever application is running in the foreground. Since few of us have the common sense to back up the work we've slaved over until after lightning knocks out the power, *OmniKey* could be a godsend. *OmniKey* can also wait until a specific set of characters is encountered on the screen and then expand them into something else. For example, the phrase "asap" can, when entered into a word processor, automatically trigger replacement with "as soon as possible."

Other notable inclusions in the package are a screen-blanking routine, file encryption and keyboard lockup, user-definable windows and menus, DOS file commands from within other programs, full-screen macro editing, and complete keyboard remapping facilities.

SRT could have quit right here and *SmartKey* would still stand on its own with no apologies needed. Instead, the company chose to package the program with yet another bonus—*SmartPrint*. This small memory-resident addition to *SmartKey* is used to send control codes to the printer from within just about any document. *SmartPrint* looks for two-character codes residing in the file and then sends the appropriate control sequence to the printer to enable capabilities like italic or double-width characters.

A run-time version of *SmartKey* is also available to software developers who wish to incorporate *SmartKey*'s features into their own package. The differences between the run-time module and the standard program are that the main program menu cannot be brought to the foreground, definition files are encrypted, and the definitions must be loaded by means of a special batch-processing program.

Although *SmartKey* operates quite comfortably with Borland's *SideKick*, *SRT* also offers a set of similar pop-up utilities of its own (named *SmartStuff*) for an additional \$29.95. It offers one feature that *SideKick* can't match: the ability to make just about any other application come up within another, such as calling up *WordStar* without exiting *I-2-3*.

SuperKey

Borland International has gone from a curiosity to a major software vendor by offering big-league programs at sandlot prices. Its Turbo Pascal programming language has become the standard PC Pascal package, and *SideKick* is the RAM-resident utility of choice for a number of PC users. *SuperKey* follows this same theme of power and versatility at a price within



FACT FILE



SuperKey, Version 1.16a
Borland
International Inc.
4585 Scotts Valley Dr.
Scotts Valley, CA 95066
(408) 438-8400
List Price: \$99.95

Requires: 64K RAM, one floppy disk drive, DOS 2.0 or later.

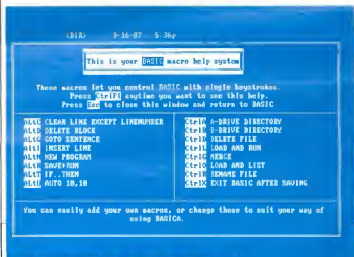
In Short: From software to documentation, *SuperKey* is only an average package. Although quite serviceable, it just hasn't kept pace with the rest of the field. Not copy protected.

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the means of any PC owner.

SuperKey (\$99.95) is the easiest to use of all of the packages reviewed here. Borland has provided a pull-down menu system that will lead the neophyte by the hand through most aspects of the program. Once you've become proficient at macro definition, you can easily bypass the menus and get straight to work.

Pulling *SuperKey*'s main menu into the foreground is just a matter of pressing Alt-/ (Slash). The cursor movement keys then



SuperKey has a full set of sample macros for BASIC programmers.

■ KEYBOARD MACROS

PC EDITOR'S CHOICE

- Metro
- Newkey

Picking a clear-cut winner from this field of functionally similar products isn't easy, but Metro and Newkey both have a little something extra to recommend them. The additional desktop utilities that are part of Metro pretty much obviate the need for additional RAM-resident programs. This should help prevent compatibility problems with other applications, and at \$85, it's really quite a bargain. Newkey, Version 4.0, gets a nod by virtue of its extremely low price and shareware distribution system. Nowhere else can you get to try a program and see if it meets your needs before forking over the greenbacks. With the new macro editor in the latest version, Newkey can now compete head-to-head with many of the other, more-costly macro packages.

Those responsible for managing someone else's microcomputer activities should also give Keyworks Advanced careful consideration. Its powerful programming language opens up a whole new array of uses for macro software, such as customized menu and help screens for virtually any application. The price, however, keeps it out of the mainstream for keyboard macro packages.

select the appropriate pull-down menu from the horizontal selections. A typical macro definition begins by pressing Alt-/MB (the "M" is for macro, the "B" for begin). You have the option of entering the menu selection keys directly or by moving a highlighted bar up and down the menu with the cursor keys. Next, you enter the keystroke you want to use to play back the macro, say F8. Enter the text the macro is supposed to contain, and finish up with Alt-/ME (for "End"). Now each time

you press the F8 key, the sequence of characters you specified for it is transferred to the application running (or even to the DOS command line). You can cut text from one application, plant it in a macro, and recall it for insertion into another program.

If the macro you've just spent some time on has any value, you'll want to save it in a macro disk file, because until you do, it's just a temporary resident in the system's RAM—when the power goes away, so does the macro. Press Alt-/MS, enter a filename, and your efforts will not have been transient. Once you've mastered macro definitions, you may want to bypass the pull-down menus and enter the commands directly into the computer's memory. One real disadvantage of this direct-driven mode is that the commands lose their adherence to mnemonics. Beginning macro recording, for instance, becomes Alt-/Equals sign>, the end Alt-/Hyphen>. But if you get confused along the way, help is as close as the F1 key.

If you've developed some substantial macros, you won't want to go through the entire sequence again just to make a simple change. Borland has provided a macro editor, which, while not very extensive, will get the job done. About all it does is move you around through the macro with the cursor keys and toggle between insert and overstrike modes. The macro you will be able to edit is limited to what will fit on-screen. For anything longer, you'll have to supply your own text editor. Both *WordStar* and *SideKick*'s Notepad proved effective for this purpose.

FOR DVORAK DISCIPLES If you're one of the three-or-so people in the world who are fascinated with the Dvorak keyboard layout, *SuperKey*'s Layout editor will brighten your day. You can use it to reconfigure the entire keyboard layout to your liking. A sample file for a Dvorak keyboard is contained on the disk. To help start you in the right direction, Borland has included a number of sample macros for popular software packages, including *WordStar*, 1-2-3, *SuperCalc3*, *WordPerfect*, and even DOS. These make a nice starting point, and you're free to edit them to suit your needs.

Data security is another feature touted

by the *SuperKey* manual. Two data encryption schemes are implemented, one of Borland's own design, the second conforming to the Data Encryption Standard (DES) established by the National Bureau of Standards. While the DES method may be more secure, the algorithm is considerably slower. After a file has been encrypted with a user-defined password, it will appear as a garbled mess if someone attempts to display it. Use this feature with a great deal of care, however, because it's easy to turn a useful file into rubbish by entering the wrong password or by trying to decrypt a file that wasn't encrypted to begin with. Should you decide to use file encryption, be sure to back up your files.

■ *SuperKey*'s Layout editor can reconfigure the entire keyboard layout to your liking.

Password protection can also be put into macro definitions and loaded from the AUTOEXEC.BAT file to lock up the keyboard and screen, preventing unauthorized use. Getting around the security in this case is as simple as booting the computer from the floppy disk drive.

The paperback manual supplied with *SuperKey* will delight beginners but might prove a bit frustrating for experienced users. It's well written and thorough—perhaps too thorough; everything is explained by showing the complete sequence of keystrokes required to accomplish a given task. Those keycap symbols get tedious after a while.

SuperKey certainly earns kudos for ease of use, but it just doesn't have as much to offer as some of its competitors. Perhaps Borland should consider bundling it with *SideKick*, a combination that could provide all the RAM-resident utilities you're likely to need.

Frank Bican is a departmental computer resources supervisor at a Cleveland medical center.

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HAVING IT ALL-

In the search for the perfect macro utility, DOS shells can be a good alternative to packages whose sole purpose is to allow you to assign multiple keystrokes to a single key. DOS shells can do those packages one better by coming with functions already assigned to keys, while still allowing you to create custom macros where you need them.

The typical DOS shell is a software package that surrounds DOS and allows you to perform most common DOS functions with a single keystroke. You can delete files and directories, copy, move, and back up files, rename files and sometimes directories, move between directories, and more.

DOS shells come in two varieties that directly affect how good they'll be at providing you with macro ability: memory resident and nonresident. Memory-resident shells are usually loaded into your RAM as soon as you boot up your system. Like *SideKick* and other RAM-resident programs, these shells are available in-

*Shopping for a DOS
shell? Double
your pleasure by
choosing one
with macro functions.*

DOS SHELLS WITH MACROS

stantly whenever you press a combination of keys.

Nonresident shells operate as regular .COM programs. You have to activate them by typing in a command, and when you quit them, they free up the memory they occupied. As DOS shells, the functional differences between memory-resident and nonresident packages is minor. As sources of macro capability, however, RAM-resident shells have the advantage. With a resident shell, both the shell's DOS commands and your custom-built macros can be available whether or not the shell is active. They can also be available inside applications, which is probably one of the key reasons you want macros in the first place.

With nonresident shells, neither the shell's DOS functions nor any other macros tend to be available when an application is running or after you've quit the shell.

DOS shells should be evaluated differently from macro packages. Their primary purpose is to make DOS easier to use.

■ DOS SHELLS WITH MACROS



DOS Shell Programs: Summary of Features

(Products listed in ascending price order)

	List price	RAM requirements	Maximem macro length	Macro editor	Memory resident	DOS functions	Keystroke recording	On-line help	Extended keyboard buffer	Cut-and-paste capability	Printer commands	Pass-word/date encryption	Known incompatibilities
Still River Shell Bill White	\$39.00	128K	Unlimited	○	●	●	○	●	○	○	○	○	None
Dirac-Tree Plus Micro-Z Co.	\$49.50	64K	550 characters	●	○	●	○	●	○	●	●	●	None
ALPS Hip-Pocket Helpers Plus ALPS	\$59.00	64K	115 characters	○	○	●	○	○	○	●	●	○	None
Hot Executive Systems Inc.	\$75.00	256K	128 characters	●	●	●	○	●	○	●	○	●	None
DOS2ools Computer Publishing Resources	\$99.00	128K	1,700 characters	●	○	●	●	○	●	○	○	●	None

— Indicates Editor's Choice ● — Yes ○ — No

They've already assigned a lot of functions to keys, so the number of keys available to you is likely to be limited. They may get around the limitation by stacking the macro ability in a separate menu. That allows them to override key assignments and make those keys available for other uses.

DOS shells are not likely to provide the full range of facilities that a regular macro package should have. You won't have any difficulty finding some extras, such as security programs or notepads, but you will have difficulty finding automatic keystroke recording and the ability to enlarge the keyboard buffer. The macros you can create with the shells will likely be shorter than what you might be able to produce with a regular macro package. That can be offset by what you can pack into the space you're allowed. Some shells let you include the shell's own commands in a macro string. That means you can cut the number of characters it takes to change directories or specify files or programs.

Despite their limitations, DOS shells can be a good choice as a source for macro capabilities. After all, they start you out with a number of macros you probably wouldn't get around to creating for your-

self. Five DOS shells that include macro capabilities are *Dirac-Tree Plus* from Micro-Z Co., *DOS2ools* from Computer Publishing Resources, *ALPS Hip-Pocket Helpers Plus* from ALPS, *Hot* from Executive Systems, and *Bill White's Still River Shell*. Reviews of these products follow. For a full survey of DOS shells—with and without macro functions—see "DOS Shells Get Smarter," *PC Magazine*, Volume 6 Number 4.

ALPS Hip-Pocket Helpers Plus

If you think you don't need—or maybe don't have room for—a memory-resident DOS shell but still want to have some of the same functions available, *ALPS Hip-Pocket Helpers Plus*, from ALPS, could be just what you're looking for.

At \$59, *ALPS Hip-Pocket Helpers Plus* is a collection of 43 independent DOS programs. You can pick and choose among them, installing only the ones you think are particularly useful. The package includes text filters; programs to run batch, sort, de-

lete, and copy operations; and a versatile keyboard macro facility. The selection is not as broad as what's included in *DOS2ools*: there are no security or encryption programs. Instead, *ALPS Hip-Pocket Helpers Plus* focuses on file-handling utilities.

But, as a group, the programs supply most of the DOS enhancements and capabilities found in a good DOS shell.

The manual is sparse but for the most part clear. A couple of pages describing general command parameters are followed by a list explaining what each of the programs is meant to do. Descriptions are limited to about two sentences each. Depending on your level of sophistication, that may be all you need. Novices and casual users can expect a little trouble understanding how to use a few programs, but most are self-explanatory. The best bet is to hone your working knowledge of DOS if you want to get the most out of these utilities.

If you happen to get stuck, there's on-line help available for each program in the *ALPS* collection. The explanations are short: they consist of a description of what the program is supposed to do, along with some examples.



ALPS Hip-Pocket Helpers Plus is a collection of 43 independent DOS utilities that you can mix and match on your system. Besides a macro-writing program, there are text filters and programs to run batch sort, delete, and copy operations.

USING KB Four programs—among them KB, the keyboard macro facility, and PSETUP, an initialization program for Epson-compatible printers—are explained in depth in the manual. Curiously, KB doesn't have any on-line help available. You're just going to have to keep rereading the five pages explaining the utility until you understand it. All the information you will need is there.

The macro facility is what makes this package. KB allows you to assign strings of commands to the full range of keys, including alternate and control combinations. The manual lists formats for identifying the keys you're assigning and a different way to identify the same keys within the text of your macro. For example, the Alt-A combination is assigned as ALTA and is simply "pressed" in a macro string as \A.

You also need to be aware of other special usages, among them the need to substitute \\ for \ when you want to change directories.

Assigning a key is simple. Just enter "kb" followed by the correct format for the key you want to assign and the macro

text string, then press Enter. With that format, it's easy to include the key definitions in your AUTOEXEC.BAT file, so the assignments are made every time you boot up your system.

KB is the least finicky of all the macro facilities reviewed. The key assignments were accepted by *WordStar* and *Lotus's 1-2-3*, although not as commands. In those cases, all KB could do was import text strings into the applications. The strings were short. With the facilities available as part of *ALPS Hip-Pocket Helpers Plus*, the longest string that could be created was about 115 characters long. That goes for command strings as well. My accounting package, as well as *SideKick* and my on-line thesaurus, did accept command input using the assigned keys.

You'll still have to be careful not to conflict with your memory-resident programs. Both *SideKick* and the thesaurus overrode KB key assignments when both tried to use the same keys.

KB's utility increases when you combine it with the rest of the programs included in *ALPS Hip-Pocket Helpers Plus*. It was no big deal to assign function keys to


the appropriate programs to produce the equivalent of a basic nonresident DOS shell. An additional combination that has a lot of potential as sort of a super macro consists of using KB to run the EXECUTE program.

EXECUTE is used with other *ALPS Hip-Pocket Helpers Plus* programs to run each line in a text file as a DOS command. The instructions to this command could be improved. As they stand, they limit its use to sophisticated users who are experienced enough to fill in the blanks and experiment with the program until they get it right. The rest of us can expect to struggle with it for a while until we get it right. The struggle looks like it would be worth it.

Despite its versatility, three major omissions were made when this package was put together. It doesn't include a key-stroke saver, and it could use a feature that increases the number of characters you can include in a macro. It also doesn't have any facility to show you the keys you've already assigned and the text you assigned to them. You'll have to keep that information in a manual log.

You can live without those features, but if the whole idea of getting the package is making your system more convenient to use, why should you?

Those are the only significant flaws. *ALPS Hip-Pocket Helpers Plus* could benefit from some of the other macro package and DOS shell add-ons, like a file editor/notespad and some sort of security utility.



FACT FILE

HIP-POCKET
HELPERS

© 1984-1986 by ALPS

ALPS Hip-Pocket Helpers Plus
ALPS
1502 County Rd. 25
Woodland Park, CO
80663
(303) 687-1442
List Price: \$59

Requires: 64K RAM, DOS 2.0 or later.
In Short: A well-chosen collection of independent utility programs. The macro program and the EXECUTE program, which reads a text file as a series of commands, are perfect complements to any DOS shell lacking these facilities. Not copy protected.

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■ DOS SHELLS WITH MACROS

ty, but it gets along fine without them.

At \$59.95, this is a great, versatile collection of file-housekeeping utilities and macro capabilities. Use it to substitute for either a resident macro package or a DOS shell, or try it as a complement to a standard DOS shell that doesn't include a macro function.

Direc-Tree Plus

Direc-Tree Plus, from Micro-Z Co., has just about everything a DOS shell should have. This package gives you a lot of features for \$49.50. Add the fact that *Direc-Tree Plus* is easy to use, and there's no question that Micro-Z has a winner here.

Easy, in this case, starts with installation. The whole procedure takes about 10 minutes, including reading the relevant parts of the manual. All you have to do is copy the program files to your disk and then answer some yes/no questions about your system. The program does the rest. Included in those installation questions is a handy feature that allows you to choose how much RAM the shell will use when it's running. You get to choose between a "normal" mode of 50K bytes and a "miser" mode of 27K bytes. If you have only a small amount of memory on your system, or if you routinely run applications that hog most of it, that choice could mean the difference between using the shell and not using it.

If you need change later on, all you have to do is rerun the installation program and change modes. It takes about a minute. The only noticeable difference between the two modes is that the normal mode responds slightly faster when you ask for on-line help and similar features. You won't notice any difference when you operate the shell itself.

You also have a choice of file editors. You can set up the package to use your own word processor, if it's able to recognize paths, or you can use the shell's own full-screen editor, a *WordStar* act-alike. Either way, you get single key-press access to an editor.

Direc-Tree Plus is activated by typing in DTRTEE at the DOS prompt. You can, of course, add that command to your AUTOEXEC.BAT file if you want *Direc-*



The macro creation screen in *Direc-Tree Plus* provides a full listing of all the macro-programming commands. The list remains on the screen as you write macros in the space above. Macros can be written to move around directories, change drives, and run programs.

Tree Plus to come up automatically every time you turn on your PC. The reason you have to enter the command is that this shell is not memory resident. It operates just like any other shell, and RAM is available for other applications. Micro-Z took this approach in order to make its DOS shell practical on smaller systems and to avoid compatibility problems with other memory-resident packages.

Some RAM-resident programs could still conflict with *Direc-Tree Plus*. My on-line thesaurus, for example, shared the Alt-F10 combination with the shell. Instead of executing the *Direc-Tree* command when those keys were pressed, my system would get the thesaurus. The problem was easily solved by reassigning the thesaurus function to other keys. (You can't reassign *Direc-Tree Plus* keys.)

Sometimes *Direc-Tree Plus*'s nonresident operation can actually be an advantage. If you spend most of your time working with only one application, you may want the shell only when you're going to do some intense housekeeping on your hard disk. You have the ability to bring up the shell only when you want it, and it's

not sitting idle, wasting RAM.

The bad side of not being resident in RAM is that none of *Direc-Tree Plus*'s features are available instantly, at the touch of a function key, unless you've activated the program already. Nor are any of the features available from within an application. That may not be important to you,

**FACT FILE**


Direc-Tree Plus,
Version 5.02
Micro-Z Co.
4 Santa Bella Rd.
Rolling Hills, CA 90274
(213) 377-1640
List Price: \$49.50
Requires: 64K RAM,
DOS 2.0 or later.

In Short: Easy to install and easy to use, *Direc-Tree Plus* has just about everything. The macro facility is limited but powerful. This is the DOS shell of choice if memory-resident operation is not important to you. Not copy protected.

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■ DOS SHELLS WITH MACROS

but with DOS shells you don't know what abilities like that are worth to you until you try them out.

TWO-PART MENU With *Dirrec-Tree Plus*, everything on your disk and in the shell is available through a two-part menu. The upper part displays a map of your disk directory tree. The lower part is a three-level command menu that shows the actions assigned to single keys first, it then will pop up with separate menus for Ctrl- and Alt-key combinations.

From the main menu you can perform a lot of basic DOS functions, including listing the files in a directory; copying, renaming, or deleting files; and running programs and applications. All you have to do is press the right function key, highlight the file on the list that pops up, and sometimes supply extra information like the new filename or the destination drive. It beats typing out cumbersome DOS commands.

You can even perform functions like copying or deleting files into batch jobs by marking the files so that *Dirrec-Tree Plus* knows which ones to act on.

The shell's pamphlet-sized manual does a great job of leading you through the details. It's concise and readable. Follow the manual, and in 15 minutes you'll know the basics of operating *Dirrec-Tree Plus*. Add 45 minutes, and you'll have it all down. But don't expect a lot of examples. The folks at Micro-Z think you're intelligent enough to see the obvious and make the correct assumptions. To get the most out of this package, you'll have to experiment with combining the features yourself.

Each function is backed up with clear prompts where they're needed, and extensive on-line help is only a keystroke away. The help screens tell you everything you need to know, and each one displays the page number in the manual where you can get more information.

MACRO FACILITY *Dirrec-Tree Plus*'s macro facility is a fooler. You're allowed to set up only ten macros, which are activated by the Alt key and one of the number keys along the top of the keyboard. Each macro can be 550 characters long; the macros can be constructed from *Dirrec-*

Tree commands as well as from DOS and applications commands.

As expressed in a macro, a *Dirrec-Tree Plus* command takes up a maximum of four characters. By including the symbols for the correct function key, you can include any action listed on the command menu in a macro. You can move around your directory, change drives, and run programs.

The manual's instructions for creating a macro are a little obscure. If your experience with macros is limited, you won't get any basic instruction here. Even experi-

■ *Dirrec-Tree Plus*'s security package allows you to password-protect files and directories individually and in groups.

enced macro builders are likely to have trouble, since the *Dirrec-Tree Plus* command characters are not well explained. The only complete listing is found on the macro creation screen, but no additional explanation or suggestions are available. Plan on doing some trial-and-error experimenting.

The macro creation screen itself is self-explanatory. You won't have any difficulty using it.

With a little imagination and a creative combination of commands, it's possible to cover a good chunk of your macro needs with *Dirrec-Tree Plus*'s macro facility—assuming that ten macros beyond what's already built into the DOS shell are enough for you.

This shell gives you two additional macro-like facilities. The first is the ability to create a one-shot autopath string in the Run Program command. If, for example, BASIC is in one directory and the BASIC program you want to run is in another, you can string them together automatically to run the program. All it takes is highlighting the files and pressing Enter. The shell fills in the path instructions.

The second facility is a blank, five-page pop-up menu. Each page holds 20 entries, so you can list a total of 100 programs and macros. To run either, all you do is bring up the correct page and press the letter corresponding to the macro or program. *Dirrec-Tree Plus* automatically supplies the path to the programs.

Dirrec-Tree Plus includes a security package, a notepad, and a mouse option. The security package allows you to password-protect both files and directories individually and in groups. You can even install levels of protection. For instance, one password could allow access to a set of directories, another just to a subset of those directories.

The notepad is a free-form database. You can use it to pin explanatory notes to your files and store addresses and phone numbers. You can use an additional program to translate the notepad's file so that it can be used by *SideKick* and other applications.

For mouse addicts, *Dirrec-Tree Plus* includes everything you need to redefine screens and to configure the shell for your mouse. The mouse file includes source code.

As a DOS shell, *Dirrec-Tree Plus* gives you an awful lot for your money. It includes most of the features that should be mandatory in a shell, and it's incredibly easy to set up and use. Its only real failing is that it's not memory resident. That means that once you've activated a program or application, you can't get at any of *Dirrec-Tree Plus*'s functions until you leave it. Whether or not that's a disadvantage is a matter of personal taste.

As a macro package, *Dirrec-Tree* has a lot of disadvantages. To begin with, if you're at all serious, ten macros are not likely to be enough. The program is also missing some important macro facilities, most notably keystroke recording and the ability to increase the keyboard buffer size.

But the program's fatal omission is that the macros are not available outside of the shell. Quit the shell, and you're back to keying in all the commands. For that matter, none of the macros are available once you're in an application, which is where macros are going to do the most good. If you want to have that ability with this program, you'll have to purchase a memory-

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■ DOS SHELLS WITH MACROS

resident macro package and run it along with your applications.

If your macro needs are restricted to issuing common DOS commands—zipping around your directories to locate files or to run programs—and if you have only a limited need for custom-built complex macros, *Direc-Tree Plus* could be for you. The program does an excellent job of providing these capabilities.

DOS2tools

DOS2tools, from Computer Publishing Resources, is not really a DOS shell—it's a \$99 package of DOS utility programs that cover a lot of territory. By using the programs that come in the package you can do everything from reclaiming wasted hard disk space to setting up macros and assigning function keys to encrypting files you want to keep secure.

Each utility in *DOS2tools* is a separate program that can be installed and run by itself. If you want to use the whole package, you can install it in a toolbox format that gives you access to the individual programs through a multilevel menu. It's up to you to decide which of the package's facilities you want to take advantage of.

If you install the toolbox, *DOS2tools* does the work for you with a foolproof INSTALL program that copies the programs to disk and also modifies your CONFIG.SYS file. Either way, the manual supplies all the information you need to evaluate the packages and make the installation.



FACT FILE

DOS2TOOLS

DOS2tools, Version 2.2
Computer Publishing Resources
8855 Atlanta St., #298
Huntington Beach, CA
92646
(714) 662-2535
List Price: \$99

Requires: 128K RAM, DOS 2.0 or later.
In Short: A high-quality package of utilities. The way to go if a DOS shell seems like too much. The six related macro programs will easily cover your needs. Not copy protected.
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With *DOS2tools*, you can choose the utilities you want to install. The selection includes four macro programs: *KEYASIGN*, *SHOWK*, *TYPEAHEAD*, and *TYPEAHE2*. The first two are keyboard assignment programs, while the *TYPEAHEAD* programs extend the keyboard buffer to make macro writing easier.

Well written and easy to follow, it covers each program separately and in depth.

If you want to take advantage of the keyboard macro program, you'll also have to modify your PC-DOS ANSI.SYS file. The IBM version allows only 200 characters to be stored as keyboard macros. The modified version allows 1,700. If you're using MS-DOS, you won't have to make any modifications. Making the ANSI.SYS modification can mess up your system, so it's important to be careful.

The macro capabilities in *DOS2tools* allow you to do more macro building than do most DOS shells. A fairly complete macro facility can be assembled from six separate programs: *KEYASIGN*, *FLEXIKEY*, *DO*, *TYPEAHEAD*, *TYPEAHE2*, and *SHOWK*.

None of these programs are memory resident. Each has to be activated separately by typing in the program name at the DOS prompt and pressing Enter. But once *KEYASIGN*, *FLEXIKEY*, *TYPEAHEAD*, and *TYPEAHE2* are activated, the key assignments and keyboard buffer size you choose remain in force until you cancel

them or reboot your system. As with any nonresident utility, none of these programs are available from within other applications.

KEYASIGN is the primary *DOS2tools* macro program. This is the one you use to create your command strings and to make your permanent key assignments. It allows you to assign macros to up to 80 different keys.

Creating a macro is fairly straightforward. Enter *KEYASIGN* at the DOS prompt, and you're given a choice of creating a new key assignment or editing a prior list of assignments. If you choose to make new assignments, an assignment screen appears, listing the key combinations you can use and illustrating the correct formats to designate the Alt, Ctrl, and other keys.

The manual is clear on what steps to follow to create the macro, but it assumes you'll know what the correct command formats are. If you're new to macros, expect to be confused.

Begin by keying in the key combination you want assigned. The program will display it on the screen and wait for you to en-

ter the command string. If you want, you can supply that by dumping out the keystrokes saved by TYPEAHE2. You can continue making key assignments one after the other until you're finished.

You then have to save the assignments and assign a filename to the file. That's followed by saving a copy of the file as an edit file. The edit file is the one you'll use to make changes or deletions.

Finally, you have to write the active file to ANSI.SYS by returning to the DOS prompt and typing `COPY filename CON`.

■ *DOS2ools* could be a great way to go if you don't want to spend RAM on a memory-resident macro package.

Your macro assignments will be available as long as your PC is on.

The *DOS2ools* manual claims that the macros should work with DOS, most IBM applications, and other programs. I wasn't able to get any response with *WordStar*, 1-2-3, or my accounting package. You'll have to experiment with your applications to see which ones will accept the macros. It's also a good idea to avoid possible conflicts by not using the same key assignments as the ones your memory-resident programs use.

ASSIGNING DEFAULTS You can assign a set of default keys and macros, already set up in a file called `KEY.ANS`. The file contains miscellaneous DOS and other commands that may or may not be of use to you. Add the path and `KEY.ANS` filename to your `AUTOEXEC.BAT` file to make those macros automatically active when you boot up. You can use the same technique to make any of your own macro files automatically active. Otherwise you'll have to write them to `ANSI.SYS` every time you boot the PC.

FLEXIKEY is an informal version of **KEYSIGN**. Most of the time you're real-

ly not sure what macros you need until you run into a situation that calls for one. **FLEXIKEY** allows you to create and store the macro on the spot. Press `Ctrl-K` to begin creating the string, choose the key you want to assign, and type in the macro. When you're finished, press `Ctrl-Z` to store the command. From then on it's available to you until you reboot.

Use **FLEXIKEY** to create temporary macros. There's no way to save the assignment to a permanent file.

DO is a one-shot macro builder that lets you put together and execute a string of commands without having to store and then delete them later. Just type `DO` and the command string, then press `Enter` to execute it.

TYPEAHEAD and **TYPEAHE2** are keyboard buffer expanders. Both let you expand your buffer from 16 keystrokes to more than 1,000—a great idea if you want to continue entering while the system is busy doing something else. The size of the buffer is up to you.

TYPEAHE2 has the additional advantage of being a keystroke saver. That means you can capture the keystrokes you need for a macro while you're entering them. It beats writing them down and reentering them later. Type `Ctrl-S` to begin saving strokes and `Ctrl-E` to end. To replay the strokes, even when you're creating your macro file, just type `Ctrl-R`.

SHOWK, the final macro-related program, will list your key assignments whenever you want. You can use it as a help screen to remind you which keys perform which macro or to make sure you don't reassign keys you're already using. **KEYSIGN** doesn't have any checks against reassigning keys that are already being used.

DOS2ools could be a great way to go if a DOS shell seems like too much and if you really don't want to spend RAM on a memory-resident macro package. With a choice of 80 keys and up to 1,700 characters per macro, you can create some large, complex command strings or even use it to import text into a file.

The macro facility could take care of the needs of most average users. It's easy to learn and easy to implement. At the same time you could also use it to run any one of the other excellent utility programs included in the package. How you com-

bine those programs is up to your imagination and will change as you gain more experience with them.

Another very promising use for *DOS2ools* is as a supplement to DOS shells that lack a good macro facility. Some very good shells don't provide anything beyond their built-in macros. These macro programs could be run as easily from inside the shell as from the outside.

However, the package does suffer from the usual problems of nonresident macro programs. Moreover, determining its compatibility with your applications is a case of trial and error.

With a little work and thought on your part, *DOS2ools* could make life easier for you whether you have only one application on your system or a dozen.

.....

Hot

Hot, from Executive Systems, is one of those rare things—a really remarkable package. It's easy to use (virtually dummy-proof), yet complex and versatile enough to make even the most sophisticated users and programmers happy. At \$75, *Hot* comes close to giving you everything you need in a DOS shell/macro writer.

Hot is a lot more than just a DOS shell. Sure, it's got a bunch of preset macros that control the most common DOS functions. But beyond that, any resemblance between *Hot* and other DOS shell programs



EDITOR'S CHOICE

FACT FILE



Hot, Version 3.1
Executive Systems Inc.
15300 Ventura Blvd.,
#305
Sherman Oaks, CA
91403
(818) 990-3457
List Price: \$75

Requires: 256K RAM, DOS 2.1 or later.
In Short: An easy-to-use, idiot-proof combination DOS shell and menu-builder. It has more than enough power and potential to satisfy even the most sophisticated user, but it can still be handled by a novice. Not copy protected.

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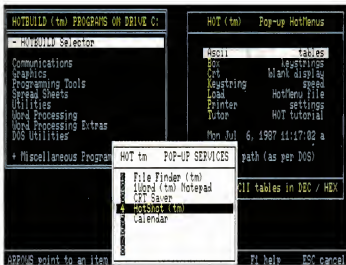
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ORDER DOG

CIRCLE 481 ON READER SERVICE CARD

■ DOS SHELLS WITH MACROS



A combination menu-builder and DOS shell, Hot also has a sophisticated macro-creation facility. The multiwindow user interface shows the services available and lists the menus you've created.

is a clear case of mistaken identity.

What sets the package apart is that it's based around an intelligent menu-builder. All those basic macros and DOS instructions are easily incorporated into stacked menus that allow you full run of DOS and your directory, and all the *Hot* features to boot. All you have to do is point the cursor and press Enter.

Included as part of the menu-building facility is the ability to create menus of your own macros. More about that in a moment.

Installing *Hot* is simple. Set up a sub-directory on your hard disk, insert the program disk in drive A:, and enter INSTALL. *Hot* does the rest. It copies the files; reads your system parameters; sets tentative defaults for your monitor, printer, and available RAM; and installs a batch file in your root directory. All in 2 to 3 minutes.

From then on all you have to do is type HOT—or include it in your AUTOEXEC.BAT file—and you're up and running. *Hot* is a fully RAM-resident program. Once it's invoked, you operate everything in your system from the shell, by means of the menus.

When it's installed, *Hot* adjusts itself to the available RAM. The more you admit to having, the more *Hot* uses—up to 148K. However, it is possible to tie to the installation program. If you want to run the program on less memory, just tell it that you have less RAM available. You may have to wait a little since *Hot* occasionally has to pull files up to memory, but functionally you'll notice little difference in the package's performance. One thing that will definitely be affected is the listing of available options on your pop-up menu. Cut the memory too much, and your ability to install and use macros could disappear.

What you do after installation depends on how sophisticated a user you are. *Hot* gives you the ability to configure the system virtually any way you want. That runs from specifying screen colors to changing function key assignments.

Your best bet is to leave all that alone until you become familiar with all the available features.

For the most part, *Hot's* manual is a technical reference. To learn how to use the package, turn to the on-line tutorial. The tutorial presents everything you need to begin using the system clearly and pain-

lessly. A really nice touch is the ability to try out various features as you read about them. A half hour to 45 minutes should be all you need to get a good grip on how to use *Hot*.

Hot supports you even when you're using it. On-line help is excellent, and most function keys will display pop-up capsule descriptions of what they're for when you point the cursor at them.

At the beginning, in order to use *Hot*, you'll need to create a menu listing everything on your hard disk, by category. Don't let that scare you. The HOTBUILD facility will do that for you. Press a single key, and it reads your directories and files, classifies the files according to the type of application (word processing, database, utilities, and so on), logs the paths to those applications, and builds the commands that get you to them.

You get a functioning menu that gives you immediate access to everything on your disk. But be prepared for some misjudgments. For example, *Hot* misinterpreted my MultiMate WP command and listed that package on the word processing submenu as *WordPerfect*. *Hot* will also dump any programs or files it doesn't recognize into a Miscellaneous category. Neither of these two factors will affect the operation of any of your applications or programs.

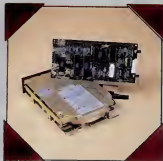
After you've learned your way around *Hot*, you can begin to experiment with

■ *Hot* is a lot more than just a DOS shell. What sets it apart is an intelligent menu-builder.

menu building by customizing and correcting the menus that HOTBUILD has created for you.

POP-UP MENU The other major *Hot* feature, the pop-up menu, is the key to creating and using your own macros. Two quick clicks on the Left Shift key cause a little menu to appear on your screen,

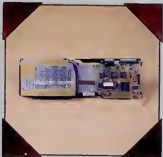
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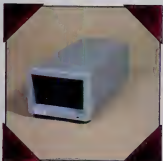
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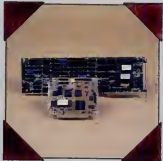
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■ DOS SHELLS WITH MACROS

whether you're in *Hot* or in an application. The pop-up facility supplies reference screens (such as a DOS command summary and an ASCII code list), a calendar, and *Hot*'s IWord notepad. It also lets you get at the HOTSHOT menus.

The HOTSHOT menus are a do-it-yourself workshop. You get a blank menu and access to *Hot*'s CHEF menu editor. You're expected to modify that menu to suit your needs. You can fill it in with macros or DOS and *Hot* commands. You can stretch it to include more slots for your command strings. You can set it up as a doorway to any number of submenus. Or you can do away with it entirely and install a text file you created elsewhere as the menu.

Entering macro text into the menu won't be any problem for even a moderately sophisticated user. The character and command conventions follow generally accepted practice for using brackets to denote commands and for spelling out or abbreviating them. Lists of what's acceptable and how to enter it are included in the manual.

To get the most out of your macros and menus, you'll have to learn a set of *Hot* commands. These include the commands you need to construct your menus; however, *Hot* also gives you shortcuts useful for moving around the directory or running programs. You'll need those shortcuts because your command strings are limited to 128 characters.

The character limitation doesn't mean that your ability to import text into a file or program is also limited. You have the ability to include commands that will copy blocks of text from one file to another.

You can also use the IWord text editor. IWord is a separate choice on the pop-up menu. It's not a full-featured word processor, and it doesn't have any print formatting commands, but it does do everything else. Use it as a general notepad to create command strings and then insert them into your custom menus. Or use it to insert blocks of text into other files. For example, you can bring IWord up while you're in your word processor, use it to change directories, list a file, pull out a block of text from that file, and then press Ctrl-K-F to return directly to your word processor and insert the text precisely where the cursor

was before you brought up IWord.

Hot includes a number of other desirable features, among them password protection for your files, a screen-saver utility, and a number of configuration options that give you a high degree of control over how the package is going to look and act.

One thing *Hot* could use is an automatic keystroke saver. The package does automatically save directory and path information, but you still have to write down and manually enter any other commands when you're building a command string. Why Executive Systems overlooked this one is a mystery.

For some people, *Hot* could be a case of too good and too much. The choices of what you can do with it are unlimited. If you're a casual user with only one or two applications, *Hot* is overkill—unless you're looking for a new hobby. But if you spend a lot of time switching from application to application, transferring blocks of text, and performing other complicated operations, *Hot* is for you. And if you've inherited the unenviable job of setting up a common interface for all the users in your office, \$75 will make you a hero.


Still River Shell


Bill White's *Still River Shell* is more than a basic DOS shell. This shareware product has all the standard DOS and file maintenance facilities you'd expect in a good shell, but it also has such a large number of options in its commands and configuration that you can use to modify it to suit the way you want to use the shell.

What *Still River Shell* doesn't have is some of the bells and whistles you'll find on other shells: features like password protection and pop-up help screens. These omissions don't make it any less useful.

Nor is this DOS shell memory resident. When you quit the shell, whatever RAM it occupied is immediately freed up. This means that the shell won't operate or issue macro commands within an application. Depending on your personal taste, that may or may not be an important point.

The user guide has very clear directions on installation and gives a follow-along demonstration of how to operate the shell. It shouldn't take longer than 10 minutes to

**FACT FILE**



Still River Shell,
Version 1.82
Bill White
P.O. Box 57
Still River, MA 01467
(617) 456-3699
List Price: \$39
Requires: 128K RAM,
DOS 2.0 or later.

In Short: More than a basic DOS shell, this nonresident shareware program can be configured to fit all but the most sophisticated needs. Setting up the macro facilities will take a bit of work, but it's worth it. Not copy protected.

CIRCLE #44 ON READER SERVICE CARD

get a grip on the basics. To go beyond the basics, you should have a good handle on DOS techniques and conventions.

Once you get past the basics of operation, the guide quickly turns into a technical manual. You'll have to wade through it a couple of times in order to get a complete idea of everything you can include in the shell. Basically, the more experienced you are, the quicker you'll understand.

Still River Shell operates as a version of the standard point-and-choose file and subdirectory list menu. The menu is divided into three parts. The left side lists the files on the directory, the right side is a system status screen, and available commands are listed across the bottom of the screen. You enter commands either by pressing Enter when the command is highlighted or by pressing the first letter of the command.

The command line then blanks, showing only the command and the filename the cursor was pointing to on the menu when the command was chosen. If any additional information is needed, such as the destination drive or new filename, you have to enter it manually at this point.

GOOD MACRO CAPABILITY Generally, in order to execute a command you'll have to press a few more keys than with some other DOS shells. *Still River Shell*'s macro capability is pretty broad. You have the ability to assign operations and macros to keys when you initially set up the shell.

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■ DOS SHELLS WITH MACROS

■ *Still River Shell* includes a limited command memory that can play back the last 20 commands.

Of course you can repeat the configuration process at any time if you want to add macros or functions.

The prime suggested use for macros in the shell is to enable some of its optional features. For example, you can use a function key to access your own word processor and then use it as a file editor within the shell. The manual and a separate text file on the program disk suggest a number of other applications and give examples showing how to set up the macros.

For the most part, you'll probably have to set up batch files containing the appropriate commands. Compared with other macro facilities, *Still River Shell* takes a

higher level of experience with DOS if it's going to be set up properly. Be prepared to work a little.

Function key macros are executed as DOS commands from within the shell, using its XDOS facility. It is possible to use macros to import blocks of text into text or program files, but you'll probably find it easier to activate your word processor and use that.

The shell is set up to make repetitive tasks easier. It includes a limited command memory that can play back the last 20 commands, in ascending order, so you don't have to rekey them again. You move from command to command by using the PgUp and PgDn keys.

This shell could use some improvements to make setting up command strings easier. A keystroke saver and a keyboard buffer extender would help.

The review copy, Version 1.82, had other limitations too, including the inability to handle file copying or deletion as a single-keystroke batch job. According to the company, that limitation, along with some other minor ones, has been corrected in Version 2.0, which should be available by the time this review is published.

Still River Shell is shareware. You can

PC EDITOR'S CHOICE

• Hot

Hot, from Executive Systems, just may be the most powerful, most versatile software package you'll ever get for \$75. As a DOS shell, it comes close to providing you with everything you want.

As a source of custom macros, Hot is likely to be harder to set up than other programs. You have to learn the basics of creating menus as well as the package's own commands. But the potential payoff, in terms of creating a no-sweat macro system, is much larger than the effort it will take to set the system up. What other macro facility, for example, lets you tack notes onto each macro explaining what it does?

If your system is growing, if you skip from application to application, or if you're looking for some way to make DOS and a lot of tedious keystrokes disappear for yourself and some other users you're responsible for, Hot will take care of you.

```

TOMOGRAPHY.AMT  A   248  R3-24-87  06:39p
SRP1            .BAT  A   127  04-01-87  09:31a
GOODIES.DOC    A   1455  02-14-86  01:53p
EE             .DOC  A   49135  07-20-87  18:53p
FUPB           .EXE  A   6592  10-19-84  04:07p
FUPBHD         .EXE  A   4923  10-19-84  04:06p
SR             .EXE  A   78680  03-26-87  08:35p
XDOS           .EXE  A   18547  04-22-85  01:10p
SR182          .LSY  A   1171  03-14-87  09:20p
CONFIG.SYS     A    13  11-23-85  06:15p

Still River Shell 1.82
Drive - C:  FAREAWAY

28946944 (bytes allocated)
10821632 (bytes free)
65 (x allocated)

Directory - C:\SHELL\
Set - C:\SHELL\*.

10 (files)
0 (directories)
169984 (bytes allocated)
91 (x used)

Copy Del Find Info List Muv Opt Prev Sort Tree View Write Xdos [F4]
[display contents of a file] (ESC) to exit
  
```

Still River Shell eschews fancy interface screens in favor of a straightforward directory that lists command summaries. Function key macros are executed as DOS commands from within the shell, using its XDOS facility. A limited command memory lets you play back the last 20 commands, in ascending order, so you don't have to rekey them.

probably find a copy on your local bulletin board and try it out for free. Like many shareware programs, the shell is well thought out and well constructed. Its big strength is in its flexibility and large choice of command options and features. This means that if you're willing to invest the time, your shell can be exactly what you need: not loaded down with features you don't want to use, and not lacking any you need.

If you're looking for a solid, utilitarian DOS shell, with just enough macro capability to cover most average needs, give this one a try. The documentation included on the disk will get you started. But if it looks good to you, spend the \$39 for the complete manual. It will help you get the most out of *Still River Shell*. □

Walt Rowinsky is a free-lance writer based in Cleveland.

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BYTE, March 1987

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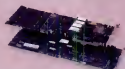
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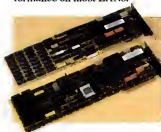
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FRANK J. DERFLER, JR.

a resource this vast, but until the appearance of the three products reviewed here, establishing the necessary linkage was a major obstacle. Now three new DEC products give MS-DOS microcomputers access to these riches. The new *VAX/VMS Services for MS-DOS* allows any VAX minicomputer to act as a server for a network of MS-DOS microcomputers. The IBM PC Network Integration Package lets you run IBM PC-compatible systems on the DECnet network. And the VAXmate is an 80286 microcomputer that runs MS-DOS or emulates a VAX terminal.

DIGITAL EQUIPMENT CORP. VAX/VMS Services for MS-DOS

When running *VAX/VMS Services for MS-DOS*, any VAX can be the server for a network of PCs. Such a configuration offers a number of advantages. Perhaps the greatest benefit of using this software is for corporations with a heavy investment in VAX minicomputers. *VAX/VMS Services for MS-DOS* allows MS-DOS machines to access files from applications programs that run on the VAX.

In addition, Digital Equipment Corp. offers several families of applications programs for its work-group environment. The company's *All-in-1* integrated office systems software—which combines word and document processing, electronic mail, and access to other business applications—has sold numerous minicomputers as office automation devices. In fact, a study by Dataquest, a computer consulting firm, shows that DEC has about 40 percent of the integrated office systems software market. Since an *All-in-1* installation for 30 users can cost over \$80,000 (with the VAX, terminals, and software), managers are anxious to make continued use of that investment by adding IBM-style PCs to the system. *VAX/VMS Services* lets them do that.



FACT FILE

VAX/VMS Services for MS-DOS

Digital Equipment Corp.
200 Baker Ave.
Concord, MA 01742
(617) 493-7161

List Price: \$1,950 for MicroVAX 2000 version; prices vary according to which VAX machine the program will be run on.

Requires: MicroVAX 2000 or VAX machine that the particular *VAX/VMS Services for MS-DOS* package is geared toward.

In Short: Though slower than other products on the PC Labs benchmark tests, *VAX/VMS Services for MS-DOS* offers an excellent way to share a VAX between network PCs and RS-232C terminals. Copy protected.

CIRCLE 671 ON READER SERVICE CARD

Organizations can buy DEC's *All-in-1* and run it on networked PCs attached through the *VAX/VMS Services* program and thus share e-mail and other files with people running the regular *All-in-1* program on the VAX. In effect, the *VAX/VMS Services* program is an invisible applications-level gateway to the VAX.

Another advantage of using the *VAX/VMS Services* program is that it allows PCs to access the VAX's potentially huge storage capability.



The Connectivity Decision Guide

This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

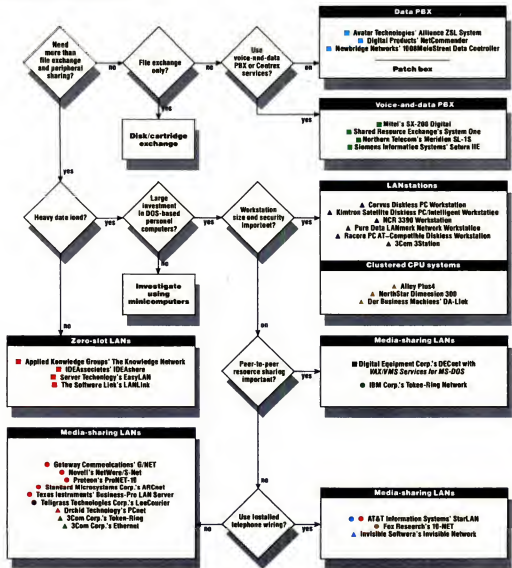
Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

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- Volume 6 Number 14



The MicroVAX 2000 is shown on the right and the accessory tape backup system is on the left. Once software is loaded on the hard disk, the MicroVAX is capable of operating without the tape unit. Connectors for RS-232C terminals, connectors for printers, and an Ethernet connector are on the other side of this otherwise featureless box.

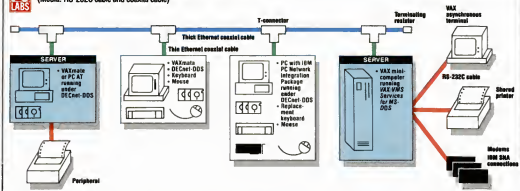


■ DEC MEETS DOS



Digital Equipment Corp.'s DECnet Topology

(Media: RS-232C cable and coaxial cable)



Digital Equipment Corp.'s open door to MS-DOS allows VAX minicomputers, such as the MicroVAX 2000, to act as the server on a DECnet network serving both VAX terminals and MS-DOS personal computers. To augment network performance, PCs such as the IBM PC AT or the DEC VAXmate can also operate as servers when running DECnet-DOS. Shared peripherals, communications gateways, and files are made available from MS-DOS workstations outfitted with the IBM PC Network Integration Package, which consists of an adapter card, a replacement keyboard, a mouse, and DECnet-DOS. The VAXmate and PCs connect to DECnet through thin Ethernet coax (green), which connects to the mini via a thick coaxial trunk line (blue). The VAX asynchronous terminals are linked with the mini through RS-232C wiring (red).

DEC also provides a total package of support, maintenance, and training. Anyone using either a terminal or a networked PC can use the same training program and set of instructions.

EQUIPMENT FOR TESTING PC Labs benchmark-tested VAX/VMS Services for MS-DOS using DEC's MicroVAX 2000 as the server for a network of IBM PC AT and AT-type systems using DEC's thin-wire Ethernet interface cards. We made no attempt to load the host-to-terminal side of the system. Any VAX can run VAX/VMS Services, but we reviewed it running on the MicroVAX 2000—a smaller, less-expensive version of DEC's already small and relatively low-priced 32 bit MicroVAX II minicomputer—because it is designed specifically to meet the computing needs of small work groups.

The MicroVAX 2000 is an 11-inch by 7-inch by 12-inch featureless beige box with a handle. The MicroVAX 2000 holds up to 6 megabytes of memory and 142 megabytes of hard disk storage, and its 32-bit processor runs the DEC VAX/VMS operating system, which is common to the entire line of DEC VAX computers. The

base price for the MicroVAX 2000 is under \$10,000 (although it hits \$13,000 in a practical configuration).

The MicroVAX 2000 can host up to 16 RS-232C terminals. At the same time, when it is running VAX/VMS Services it can also act as a server for a network of IBM PC-type computers operating under MS-DOS.

VAX/VMS Services is the portion of the network operating system that runs on the server. It acts as an application under the VAX/VMS operating system. All the files in the VAX are stored in VMS format. When files are written or read by the MS-DOS machines on the network, VMS does the actual work. It is this common storage format that makes it easy for other applications programs running on the VAX to share the data.

The programs in the VAX/VMS Services package, which run on the network server, are derived from Microsoft Networks, a series of software modules that perform various networking operations and are repackaged by a number of vendors, including 3Com, AT&T, and Ungermann-Bass. The PCs on the network that use VAX/VMS Services run an adaptation of MS-DOS

and Microsoft Networks called DECnet-DOS. (See sidebar "A Look at DECnet.")

The VAX computer that runs VAX/VMS Services takes on the functions of a file server, a print server, and a communications server in the network. PC workstations on the network store and share files in the VAX's hard disk system and use printers attached to the VAX. Storage capacities of many hundreds of megabytes are available to PC users if a large VAX system is on the network. Because DEC's designers have worked diligently to create communications links between the VAX and other computer systems (such as IBM's SNA mainframes), PCs on the network can use the VAX's gateway services to these other computer systems.

While all this network service is going on, the VAX's traditional host services remain available to the RS-232C terminals. People at terminals still run their programs in the VAX while people on the PC network run programs in their PCs and use the VAX as a server. The MicroVAX 2000 has an excellent status-monitoring system to track this activity, and even while the computer we tested was heavily loaded with network tasks, the processor loafed at



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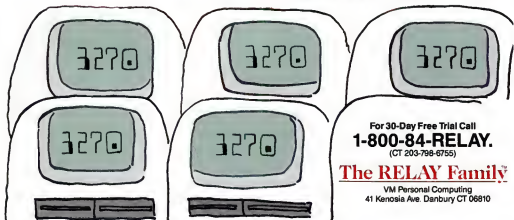
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A LOOK AT DECNET

Digital Equipment Corp. considers itself to be a networking company and offers DECnet as its networking product. It is into this network that DEC's IBM PC Network Installation Package allows you to bring MS-DOS computers.

DECnet's architecture has functional layers such as those found in IBM's System Network Architecture (SNA) or the International Standards Organization Open Systems Interconnection model. In such an architecture, you can think of the network functions as separate layers that to pass information from one network node to another. In practice, a single piece of hardware or software can perform several layers of network functions. But the layered network architecture allows a different piece or type of hardware or software to perform the same function in different network nodes.

For example, the lowest layer of any network model is the physical layer. You can make physical connections through RS-232C cable, coaxial cable, telephone wire, twisted-pair wire, or fiber-optic cable. All of these hardware solutions provide the same function, that of making connections between machines, but the layered architecture allows you to mix these media on some networks.

DECnet provides the function of the physical layer in two ways, either through RS-232C serial connections or through the Ethernet standard. Traditionally, DEC's minicomputers have used RS-232C connections to their terminals. Using serial connections also makes it easy to extend network services across

country or across town via modem.

DEC was one of the original companies involved in the development of the Ethernet standard. Its network is based on Ethernet, and all of its larger computers are equipped to communicate through this system. Ethernet uses coaxial cables to connect network nodes using the carrier sense multiple access (listen before talk) network-sharing protocol. Several different kinds of cables and hubbing devices can be used with DEC's version of Ethernet.

DEC's Network Integration Package for IBM PC-type systems includes DEC's Ethernet interface board, but you can also use similar boards from 3Com and Mitel.

ALPHABET SOUP Software modules comprise the higher levels of the DECnet architecture. A description of DECnet would not be complete without some taste of the naming scheme used by DEC to designate the pieces of software in the system and their functions.

People using MS-DOS standard systems are probably most interested in DECnet-DOS, an expanded version of MS-DOS. DECnet-DOS is an operating system designed to allow integration of PCs with various DEC operating systems. The core modules that make up DECnet-DOS are called the DECnet Network Process (DNP), the Data Link Layer (DLL) and the Real-Time Scheduler (SCH).

Other utility programs run on top of these three modules and perform important network functions. For example, the

Network Control Program (NCP) configures the network names and passwords and establishes access security for files on your networked PC. The NCP contains its own programming language of 11 command verbs used to set up nodes, define parameters that take effect after you reboot your system, and monitor network activity.

The Network Test Unit (NTU) is a diagnostic system that performs loopback tests (tests that take the transmitted data and loop it back to the receiver side to enable a self-test of the unit) and displays information. The Network File Transfer Utility (NFT) augments the DOS file handling commands and gives you the power to perform such tasks as appending two or more files and defining and displaying access control information. The Network Device Utility (NDU) controls your use of remote printers and disks and the File Access Listener (FAL) lets other stations use your files and disks through the network.

Once you speak the language, you can use these acronyms to describe DECnet's pieces and functions. Fortunately, you don't have to speak the language to use the system effectively.

TOTAL SOLUTIONS DECnet provides total connectivity and applications software solutions for both VMS- and MS-DOS-based computers. Along with a possibly bewildering collection of acronyms, the network delivers flexible and integrated solutions at prices that are not as high as alternatives like IBM's SNA. —Frank J. Derfler, Jr.

a mere 1 or 2 percent of utilization.

We had no way of measuring the mutual performance degradation caused by the interaction between host services and network services, but we are certain that servicing the network will not slow down processor-intensive tasks on the host side. However, contention for disk access between stations running a networked DBMS and (in the worst case) terminals

compiling programs on the host side would have a significant effect.

INSTALLATION Overall, installing VAX/VMS Services for MS-DOS on the MicroVAX 2000 and setting up the network is no more difficult than performing the same job with 3Com's 3+ Share or Novell's Advanced NetWare. You can quickly load the programs providing the MS-

DOS services into the MicroVAX with a tape cartridge. The programs are run as applications under VMS. The console for the VAX (a separate DEC terminal) displays a series of menus used to authorize users on the system, establish their passwords, and describe their capabilities.

The Personal Computer File System Administration Utility (DEC people have a Germanic penchant for long descriptive ti-

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Second-Generation LAN Tests

With this issue, we introduce a new suite of LAN benchmark tests. The new tests, written in C, are independent of commercial software. They are designed to be simpler to use than the previous version and to have improved repeatability in a nonlaboratory environment. To make them suitable for distribution with other PC Labs benchmark tests, we removed commercial software used previously and created compiled programs that perform standardized workload tests.

Additionally, we upgraded our PC Labs test bed from a mix of PCs, XT's, and AT's to include only 8-MHz IBM PC AT's. The faster I/O capability of these AT's allows us to load the network more heavily. (In this issue we tested the DECnet system on a network with four workstations.)

Few, if any, actual PC-based network installations create as much work load on the components of a network as these tests do. But for our test bed to better simulate the conditions on a medium-size network of 20 or more workstations, the loading tests are designed so that a single station represents five to ten times the load of a user performing an interactive task (for example, updating records) on a network.

By themselves, the elapsed times reported in these tests are not meaningful. They are valuable only when used to compare the performances of two or more systems running under near-identical conditions. Accordingly, we include results from a network made up of Novell's Advanced NetWare/286, EtherLink cards, and an IBM PC AT as the server to provide a point of comparison. Advanced NetWare is our Editor's Choice for networking software, and our tested configuration is a typical one.

Comparing the performance of a network under these tests with that of a network tested with PC Labs' old benchmark tests is valid only if there is a relative index. To help you compare the performance of networks run under the new and the old benchmark tests, we've included a table showing the results of both tests run on 3Com's 3Server3 running under 3+Share with EtherLink interface cards. Identical server, cable, and interface card configurations were used for both the new benchmark tests and the old tests. The raw numbers and especially the percentage change in performance times as workstations are added can serve as an index of relative performance between the new and old tests. We used these results because this configuration is an Editor's Choice.



Benchmark Tests: DECnet

Digital Equipment Corp's DECnet system displayed a slower response time in our benchmark tests than popular 3Com and Novell alternatives. Because VAX/VMS Services for MS-DOS is an application running on the VAX, it must receive the request for action from a DOS workstation and pass it to the VMS operating system for completion. Similarly, the response from VMS must be converted into a format DOS can use. This conversion process adds overhead to the system during every activity.

Additionally, DOS makes requests for certain amounts of data during specific operations. These block sizes may not match the typical buffer and cache allocation of the operating system. Certainly, with experimentation and tuning, the response of the VAX-to-MS-DOS service requests could be improved.

The Network Speed Under Load test is influenced by the ability of the network protocol to handle contention among the 8-MHz workstations for network access and by the ability of the networking software to respond to requests for service. Note that while the total elapsed time was considerably greater for the DEC system than for the alternative systems, the increases as more stations were added were quite small.

The Hard Disk Access Load test demonstrates the effect of loading the hard disk drive. Note that response times rise at a faster rate. Experimentation and tuning of the buffers in the system would improve response times for certain applications.

Network Speed Under Load

Performance Times

(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
MicroVAX 2800/Digital Equipment Corp.	Ethernet	VAX/VMS Services for MS-DOS	1,156	1,266	1,345	1,482	1,642
3Server3/3Com Corp.	EtherLink	3+Share	306	432	529	651	761
8-MHz IBM PC AT/IBM Corp.	EtherLink	Advanced NetWare/286	264	280	301	310	322

Hard Disk Access Load

Performance Times

(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations
MicroVAX 2800/Digital Equipment Corp.	Ethernet	VAX/VMS Services for MS-DOS	583	672	1,297	1,619	2,309
3Server3/3Com Corp.	EtherLink	3+Share	155	227	330	419	522
8-MHz IBM PC AT/IBM Corp.	EtherLink	Advanced NetWare/286	136	150	162	174	182

The Network Speed Under Load and the Hard Disk Access Load benchmark tests measure the time needed to perform a standardized task on the network. While the actual work loads used for these two tests (described below) are different, we used the same procedures for both. To obtain the elapsed times shown here, we ran a benchmark program performing a sequential create, a sequential read, a sequential write, a random read, and a random write

of a large file. The record sizes used in these activities systematically rotate between 16K bytes, 4K bytes and 512 bytes. The numbers shown in the three-dimensional chart are the total time necessary for all of these operations. We ran the test on all of our AT's to load the network while timing just one of them. We then reduced the number of workstations one at a time to show the effect of loading on the network.

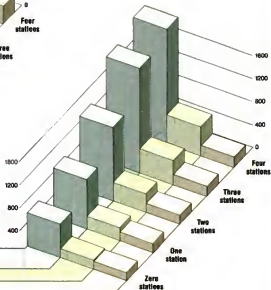
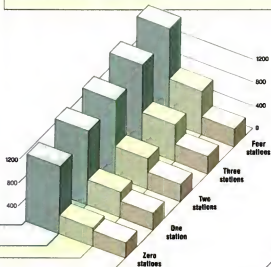
Comparing Old and New LAN Benchmark Test Results

All results were obtained from a system comprising 3Com Corp.'s 3Server3 server, 3+Share software, and EtherLink interface cards.

Performance Times

(Times given in seconds)

	Zero stations	Percent change	One station	Percent change	Two stations	Percent change	Three stations	Percent change	Four stations
Network Speed Under Contentious (old results)	44	23	54	22	66	15	76	28	97
Network Speed Under Load (new results)	306	41	432	22	529	23	651	17	761
Network plus Server Crawler (old results)	44	43	63	25	79	24	98	14	112
Hard Disk Access Load (new results)	155	46	227	45	330	27	419	25	522



The Network Speed Under Load test puts a heavy load on the network interface (cards, media, and so forth) while placing a minimal load on the hard disk by having each station continuously read and write its own 1-byte data file, changing the data each time. For systems with disk caching, the load on the hard disk is even smaller, since cached systems typically perform a disk write but do not require a physical disk read.

The Hard Disk Access Load test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K-byte data file using 1K-byte records. Data written to the file is changed each time. The random reads typically access data outside the cache, which forces a disk read, as does any write.

■ DEC MEETS DOS

ties and a DoD-like love of pronouncing acronyms) comes up on the VAX console and offers 11 menu selections. These allow the administrator to add or delete nodes (by node address), users (by name), common and application-specific directories, and print queues. We found that a person familiar with both VMS and the VAX/VMS *Services* application can load the software and create a system for five nodes and five users in about an hour.

The most important factor in determining the installation time for the system is the quality of information available about the users. If the names of the applications directories, the authorized capabilities of the users, and other factors are determined before the installation begins, the job is more likely to progress smoothly.

PERFORMANCE The MicroVAX 2000 is not the fastest server we have ever tested, but it performed well and rivaled the 3Com Server3 in some ways in actual use. This series of tests demonstrates that processing power does not determine server speed; rather, fast input/output is what counts.

The I/O speed of the MicroVAX is slowed because it works through the VMS operating system. In effect, the MS-DOS operating system in each network workstation makes a request of the VAX/VMS *Services* program in the MicroVAX, and the VAX/VMS *Services* program translates the request and passes it on to VMS. VMS produces data or a reply that must then be translated back into DOS. All of this translation takes time. However, people who want to share application files between terminals running under VMS and PCs running under MS-DOS will probably be happy to have adequate, if not exactly blazing, response time in return for greater operational productivity.

The MicroVAX system had a particularly difficult time handling requests for small blocks of data. We suspect this is caused by the data buffers established in the system. Requests for data blocks of 1K byte or less are made frequently in MS-DOS-based systems, so we feel the test is valid, however, we are also certain that with simple experimentation its performance handling small data blocks can be dramatically improved.

BOTTOM LINE We found no performance or technical reason to buy a VAX and dedicate it to acting as a server on a LAN of PCs. Other servers, even the sometimes-maligned 8-MHz IBM PC AT, will work as well or better if they have the right disk drives and networking software. However, there are excellent productivity and system management reasons to share a VAX between networked PCs and RS-232C-connected terminals. The VAX/VMS *Services for MS-DOS* package works well and should be a major consideration for any organization needing a blend of PC- and terminal-based applications.

DIGITAL EQUIPMENT CORP.

VAXmate

Digital Equipment Corp. has for 5 years offered a semi-MS-DOS computer called the Rainbow. In its day, the Rainbow was an advanced machine, featuring, for example, the modular snap-together construction just introduced by IBM in the PS/2 series. But while the Rainbow is not IBM PC compatible, DEC's recently re-



FACT FILE

VAXmate

Digital Equipment Corp.
200 Baker Ave.
Concord, MA 01742
(617) 493-7161

List Price: \$4,045, including 1 Mbyte RAM, 1.2-Mbyte floppy disk drive, three serial ports, built-in Ethernet transceiver, video controller, monochrome display, keyboard, mechanical mouse.

In Short: The VAXmate personal computer emulates a VAX terminal on the DECnet network and also functions as a standalone IBM PC compatible. It has a good ergonomic design.

CIRCLE #73 ON READER SERVICE CARD

leased VAXmate, based on the 80286 processor, is.

Like VAX/VMS *Services for MS-DOS*, the VAXmate bridges the gap between VAX and PC-type machines. The VAXmate emulates a VAX terminal on the DECnet network and also functions as a



The VAXmate system unit on the left uses convection cooling, so it is totally silent except for the fan. The vertical floppy disk drive next to the screen is normally hidden behind a plastic door. The keyboard and mouse, which are designed to facilitate the use of programs designed for both MS-DOS and VAX applications software, connect through long cables that allow plenty of flexibility. The optional expansion unit, on the right, holds a 20-megabyte hard disk. It sits under the VAXmate and attaches through mating connectors built into the cabinets.



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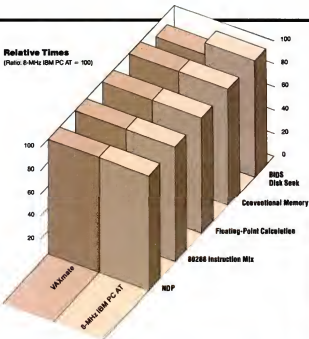
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Benchmark Tests: VAXmate vs. IBM PC AT

Although Digital Equipment Corp.'s VAXmate is configured differently from an AT and has different expansion capabilities, it is the operational equivalent of an 8-MHz AT in the area of processor and memory tests.

Relative Times
(Ratio: 8-MHz IBM PC AT = 100)



Performance Times

(Times given in seconds except where noted)

	NOP	80286 Instruction Mix	Floating-Point Calculation	Conventional Memory	BIOS Disk Seek (milliseconds)
VAXmate	4.2	9.0	35.5	1.3	39.6
8-MHz IBM PC AT	4.2	9.0	35.6	1.3	42.5

The NOP benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The 80286 Instruction Mix benchmark test measures the time it takes to execute a selected series of processor-intensive tests. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

The Floating-Point Calculation benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The Conventional Memory benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The BIOS Disk Seek benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.

standalone IBM PC compatible. You can further see DEC's intent to integrate the machine into the network in the VAXmate's internal Ethernet interface and in its keyboard, which comes with a mouse and is designed to function with both IBM PC and DEC integrated software.

Aesthetically, the VAXmate isn't very stylish, which is surprising since the much older Rainbow is still considered a good-

looking computer. The VAXmate is totally contained in a boxy but functional CRT cabinet holding a 5¼-inch floppy disk drive in a vertical position on the right-hand side. The disk drive hides behind a plastic door on an unsubstantial hinge. With the disk drive door closed, the VAXmate looks like a terminal instead of a PC, which is probably just what the designers intended.

But the VAXmate happens to be well designed ergonomically. The system is convection cooled, and so, except for the disk drive, it makes no noise. The VAXmate's footprint measures 16 inches wide by 15½ inches deep. Despite its lack of a fan, it doesn't put out much heat and it should be a good companion in modern offices favoring small cubicles and modular room dividers.

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PC Magazine Profile *EasyPRINT*

- | | |
|--|-----|
| ■ Hook up any number of PCs to a printer. | Yes |
| ■ Support your choice of: | |
| Letter Quality | Yes |
| Dot Matrix | Yes |
| Laser | Yes |
| Plotter | Yes |
| ■ Large segmented print buffer. | Yes |
| ■ Accept all incoming print jobs no matter if the printer is busy. | Yes |
| ■ Support mixed serial and parallel devices. | Yes |
| ■ Any 3-4 users should be able to justify a joint purchase of all three printer types. | Yes |

Highlights

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—PC Magazine, April 28, 1987



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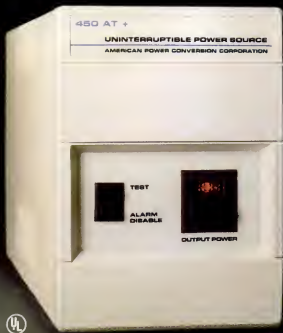
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■ DEC MEETS DOS

In addition to the built-in Ethernet transceiver, video controller, 1 megabyte of RAM, two serial ports, and a parallel printer port, the base VAXmate system is designed to accommodate an additional 2 megabytes of memory, a modem, and a math coprocessor board. The floppy disk drive has a 1.2-megabyte capacity and is able to exchange floppy disks with IBM PC AT systems. In our *PC Magazine* benchmark tests, the VAXmate turned in exactly the same score as an IBM PC AT running at 8 MHz.

HARD DISK SUBSYSTEM A 20-megabyte hard disk subsystem is also available for the VAXmate. It comes in a unique subchassis that fits under and mates directly to the system unit holding the monitor, CPU, and floppy disk drive. Connectors molded into the cabinet attach directly and eliminate the need for external cables. The expansion box for the hard disk subsystem also contains two IBM PC-compatible expansion slots.

One limitation of the VAXmate is that it comes with only a monochrome display. The display supports both the DEC 800 by 250 and 640 by 400 graphic modes and the IBM 320 or 640 by 200 modes. You can order the VAXmate with either a green or an amber display. The system designers at DEC are sold on *Microsoft Windows* and have given the VAXmate full capability for running it.

The VAXmate is a pleasure to operate. The system unit is small and (unless you have a hard disk expansion unit) absolutely quiet. The screen has excellent quality, and the keyboard has a logical and useful layout. The keyboard sports 14 special function keys, separate cursor control keys (but in an inverted-T formation, not a diamond), an oversize Return key, and a very long cord. The system's three-button mechanical mouse is nicely shaped to fit the palm of your hand. (If there were ever a contest for mouse ergonomics, the DEC mouse would probably win.) Although I still don't love its boxy design, the VAXmate is sleek where it counts.

The VAXmate system hardware is priced at \$4,045. While this isn't a bad price for an AT compatible, you can find many other AT-alternative systems (including 80386-based machines) that sell

■ DEC MEETS DOS

for much less. So why would someone buy a VAXmate?

For one thing, most organizations using larger DEC computers won't buy just one VAXmate. They will buy many and get a quantity discount. Second, the price includes on-site service for 1 year. Since this maintenance is done by the same people who repair the rest of your DEC equipment, you have only one place to call for maintenance. DEC also offers software telephone support and on-site system training. Finally, the VAXmate is integrated into the DECnet system both in hardware and in software.

I think DEC hit the target it was aiming for. The VAXmate isn't every person's PC, particularly since it doesn't have color graphics. But it is an excellent combination of a LANstation for DECnet and a personal computer system for word processing and other office applications that don't need color.

DIGITAL EQUIPMENT CORP. IBM PC Network Integration Package

Digital Equipment Corp.'s recently released IBM PC Network Integration Package allows you to integrate IBM standard PCs onto the DECnet network. The kit is a hardware/software combination, including an Ethernet card, a keyboard and mouse, and DECnet-DOS.

The Ethernet card that comes with the



Digital Equipment Corp.'s IBM PC Network Integration Package for IBM PC-type systems includes an Ethernet network adapter card, a keyboard, a mouse, DECnet-DOS, and documentation. The mouse plugs into the network adapter card to save connections. Also shown are the gray Ethernet cables and coaxial T-connectors with knurled plastic knobs favored by DEC. The T-connector on this board is topped by a terminating resistor used at each end of the Network Integration Package.

kit fits in one full-length PC slot. This card has a connector for thin Ethernet (RG-58) cable. The card is typical of devices of this sort, with jumpers for DMA (direct memory access), interrupt, and memory address selection like similar cards from 3Com and Novell.

The included keyboard has extra function keys that make it compatible with DEC applications and emulate those on the DEC VT series of terminals. The keyboard also has all of the keys needed to make it compatible with IBM PC and AT systems and software. The keyboard and mouse are the same as those described in the review of the VAXmate.

Substituting a new keyboard is an excellent way to get the additional keys needed to run DECnet applications without resorting to reusing special function keys or remapping other keyboard functions. The planners at DEC figure, rightly we think, that it is more economical to substitute a specialized keyboard than to change training materials and manuals and thus get limited functionality by trying to reuse the old keyboard.

A critical component of the DEC integration kit is DECnet-DOS. DECnet-DOS includes the features found in generic MS-DOS, but it also has many added features that allow it to work with networked systems. This operating system runs fine on an IBM PC in standalone mode, but the standalone mode misses a great deal of its functionality. By the way, the version numbers of DECnet-DOS don't seem to parallel MS-DOS versions as the version numbers of IBM's PC-DOS do. For instance, DECnet-DOS 1.1 is compatible with MS-DOS 3.1.

DECnet-DOS is a total network operating system. All workstations running under DECnet-DOS and connected over Ethernet cable can contribute resources to the network. This software provides the file service, printer sharing, security, and other services needed in a server, plus the redirection of DOS commands needed in a workstation.

The sidebar "A Look at DECnet" describes the primary features of DECnet and DECnet-DOS. Although DEC has a bewildering array of acronyms describing



FACT FILE

IBM PC Network Integration Package

Digital Equipment Corp.
200 Baker Ave.
Concord, MA 01742
(617) 493-7161

List Price: \$1,195, including Ethernet card, Ethernet thin-wire cable assembly kit, mechanical mouse, keyboard, DECnet-DOS client software license, manual; \$895 without mechanical mouse and keyboard.

In Short: This kit allows you to integrate IBM-standard PCs onto the DECnet network. It comes with an Ethernet card, a keyboard and mouse, and DECnet-DOS.

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■ DEC MEETS DOS

subprograms that handle network management, remote file access, file transfer, and other activities, in practice these programs are invisible to the people using (as opposed to administering) the system. The files located on the DECnet server (either a VAX running VAX/VMS Services or a PC or VAXmate running DECnet) are available to network users as additional disk drives on their PCs. Standard DOS commands are used to access files and to transfer them between VMS-based and DOS-based servers on the same network.

DEC's Network Integration Package is easy to install. The cable from the keyboard plugs into the same connection as the standard PC or XT keyboard does. The board slides into an empty 8-bit expansion slot, and the mouse plugs into the Ethernet interface board. This is an intelligent arrangement for connecting the mouse, since it saves either the serial port or expansion slot used by typical mouse interfaces.

The DECnet software loads automatically through a program called the DECnet-DOS Installation Procedure (yes, DEC calls it DIP). DIP checks to see if your PC is configured with the proper operating system and with sufficient memory and disk space. Then the program presents a menu-driven series of steps that configure the network parameters and install the appropriate DECnet-DOS utilities.

DIP also automatically creates or modifies existing CONFIG.SYS or AUTOEXEC.BAT files to set the right number of files and buffers, to set the last drive specification, and to load and start the networking programs.

Like IBM's *PC Local Area Network Program* and other *MS-Net*-based network programs, DECnet-DOS is not very easy on RAM. A minimum configuration for Ethernet communications consumes about 105K bytes in addition to whatever DOS takes. Adding the ability to donate resources to the network (that is, to act as a server) takes more than another 100K of RAM.

Configuring the DIP menu items referring to the network is probably a job for the network administrator. But installing the rest of DEC's Network Integration Package in an IBM-standard system is a simple task that anyone with a screwdriver can handle.

MULTIPLEX for PC-to-Host SYNERGY

With Multiplex, your PC applications can use data previously locked away on corporate minicomputers.

FRANK J. DERFLER, JR.

The most common application in the minicomputer world is the database management system, which often comes in the form of accounting, inventory, reservation, or other applications.

Since so much corporate data is stored on minicomputers, it would be helpful if you could use your PC to work with that data. Extracting data from a minicomputer DBMS and bringing it to a PC applications program, however, has traditionally been a complex task. But a new program called *Multiplex* connects PC applications to database management systems on host computers running Xenix, UNIX, VAX/VMS, and similar operating systems.

TRANSFER TECHNIQUES Traditionally, users wanting to connect a PC to a host computer had three choices: terminal

emulation, file transfer, and virtual file storage.

Terminal emulation lets you use the PC as a terminal to run programs on the host. But terminal emulation doesn't take advantage of the PC's standalone processing capabilities or provide any synergy between PC applications and host DBMS programs.

File transfer products, such as *Blast* and *Kermi*, allow you to move files between the PC and the host, but they don't translate between the file formats used in the host and those used in the PC. Some database management programs create a program-to-program link between PC and minicomputer versions of the same product, but they work only for specific programs.

Finally, virtual file storage systems

■ MULTIPLEX



With Multiplex software installed on both your PC and a host minicomputer, you can download a variety of DBMS files from the host for use on your PC while keeping the file formats intact. The hookup can be made with either RS-232C or LAN connections.

make the host a file server for a network of PCs. This type of connection uses the facilities and peripherals of the host for file storage, but it does not guarantee transfer of files between applications in the host and in PCs.

Because applications for the PC, such as Lotus's 1-2-3, and for the DEC VAX, such as the RMS DBMS, use different binary data file formats, it is difficult to share data between these applications. And even though some reformatting utilities are available, these utilities may lose information such as dollar signs and formula for-

mat when they translate between application file formats.

With *Multiplex*, however, you can use 1-2-3 to analyze financial results from an accounting database run on the VAX or to read and edit reports created by the corporate DBMS using a word processing product on the PC.

To use *Multiplex*, you must run a portion of the *Multiplex* system in the PC and another portion in the host. But *Multiplex* doesn't care how the PC is connected to the host. You can make the connection through RS-232C cables or a local area network. You can run *Multiplex* over a number of networks, including DECnet and Sun's NFS.

The portion of the *Multiplex* system running on the host interacts with the host's DBMS to create a query or report. The portion of the system running on the PC takes the output of that query and translates it into one of several formats commonly used by PC applications programs. *Multiplex* will start the PC applications program and maintain contact with the host in case more data is needed. The PC file formats *Multiplex* can create and the host DBMS programs it can query are shown in the "Multiplex File Formats" table on this page.

Versions of *Multiplex* are available for host computers running under the MS-

DOS, UNIX System V, Berkeley UNIX, Xenix, and VAX/VMS operating systems. These include machines marketed by DEC, AT&T, Altos, Hewlett-Packard, IBM, Motorola, NCR, Plexus, Pyramid, and Sun.

Multiplex File Formats

Host DBMS programs <i>Multiplex</i> can query	PC file formats <i>Multiplex</i> can create
HPSQL	.WKS (1-2-3, Symphony, and other programs)
Informis-SQL	.DBF (dBASE, Framework, Reflex, and R-base)
Ingres	ASCII text (word processing programs)
Oracle	SYLK (Multiplan, Microsoft Word, Microsoft Chart, and other programs)
Unity	.DIF (Many graphics and spreadsheet programs)
VAX RDB	
VAX RMS	

TOTAL SERVICE *Multiplex* is not a utility; it is a complete environment for connecting the PC and the host. *Multiplex* performs all communications steps, DBMS inquiry activities, translations, and control of PC applications. You choose the PC application and initiate communications from the *Multiplex* menu. You look at the data in the host DBMS through *Multiplex*'s row-and-column format.

Multiplex works through the log-in password protection of the host and respects the access rights and limitations established on the host machine. It runs as a user-level application on the host and does not give the PC user the ability to change the data—only to browse, view, and capture it. You can upload files from the PC to the host through several *Multiplex* options, but that is a communications function and not a data translation function.

INSTALLATION You must install *Multiplex* on both the host and the PC. The program runs in PCs with 256K bytes of memory. You don't need a hard disk. *Multiplex* occupies only about 6K of RAM when the data captured from the host is being processed by applications on the PC.



FACT FILE

Multiplex

Network Innovations Corp.
20863 Stevens Creek Blvd.
Cupertino, CA 95014
(408) 257-6800

List Price: \$695 to \$20,000 (depending on host configuration) for the host program and an unlimited number of workstations.

Requires: 256K RAM, two disk drives, DOS 2.1 or later.

In Short: An effective and easy-to-use product for those who need to use a PC to access and use data stored on a minicomputer. Not copy protected.

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■ MULTIPLEX

NETWORK/PC/HOST CONFIGURATION

```

NETWORK: Type..... Async-Packet
          I/O Port.... COM1
          Speed..... 9600
          Parity..... None
          Data Bitts... ASCII-8
          Flow Control. Both
          Pkt Length... 256
          Host Name....

PC/LOCAL: Work Dir.... c:\nimp
          Macro Dir.... c:\nimp
          Display..... IBM-Color
          Printer..... Parallel interface

HOST: Work Dir.... /ener/np/demo
      User Name....
      Password....
      Prompts:
        Login..... "login: "
        Password... "password:"
        Command... "g "
      Auto-Connect. Manual
      Logout..... "exit"
      Timeouts:
        5 seconds
        5 seconds
        15 seconds
  
```

The Multiplex Configuration status display contains entries for the basic communications link and a script describing how the dialogue between the PC and the host should be handled. Standard UNIX and VMS configuration files are shipped with Multiplex.

APPLICATION CONFIGURATION

```

ENLINK: Template Dir. c:\nimp
        Brand..... Infracore
        Name..... mpxdemo
        User Name.... (none)
        Password.... (none)
        Title..... No
        Delimiter.... ' '

FILE-MGR: Convert EOL.. Yes
          List Detail.. No
          Auto-Name.... Lower-Case
          File Headers. Yes
          View Mode.... Text

TERM-EMUL: Keymap File.. vt100
          Menu Key.... (F8)
          Print Key.... (ALT-P)
          Capture Key.. (ALT-C)
          Line Wrap.... Yes
          Local Echo... No
  
```

The Multiplex program must know the brand of DBMS being used on the host system. A screen follows that specifies the different PC applications used and the directory the application is in.

Multiplex's PC installation program is a batch file that asks for the name of the target drive and then moves the files. It requires no options or extensions.

The host installation process is different for various computer and operating systems but typically involves inserting a data

cartridge or floppy disk into the host and running an installation script.

When you use Multiplex, you'll see a Lotus-like interface with the alternatives listed on the top of the screen and a row-and-column format below. You also select some functions through a window that ap-

pears in the middle of the screen.

You can log on to the host computer manually, or, more typically, Multiplex will do the job automatically. You can store the user's name and password in the Multiplex Configuration menu. The data is in an encrypted format, so creating the automatic system doesn't jeopardize security.

Once the Multiplex program on the PC and the Multiplex program on the host establish communications, you see a spread-

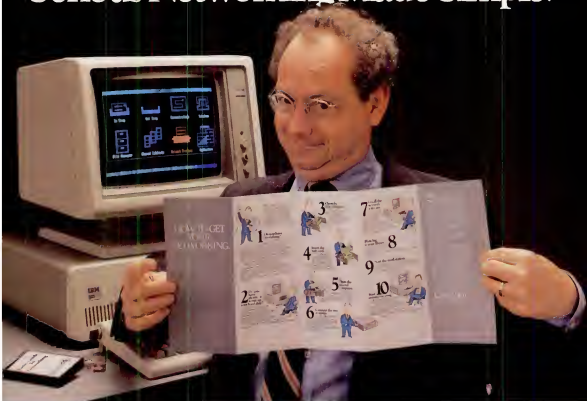
■ You can log on to the host computer manually, or Multiplex will do the job automatically.

sheet-style display of the database program on the host. The Multiplex program enters the data dictionary of the host DBMS and presents an image of how the host database is constructed. Choosing the Multiplex Browse command lets you move around inside the database and select the tables you want to link and fields you want to use in a database sort. This DBMS interface is similar to that of the Paradox DBMS for microcomputers. Multiplex automatically translates the output of the DBMS/Multiplex interaction and gives it to the selected PC application.

An important aspect of Multiplex is its recording and self-running feature. As you go through a communications and data extraction session, the program records your steps. The recording process creates an ASCII file that holds the macro commands and that can automatically rerun the session. You can edit and make comments in this macro file. This file runs the entire session up to the point of starting the PC applications program. At that point, programming languages such as the I-2-3 macro language can take over the processing task to make the entire process run in a hands-off mode.

While a PC-to-host session is running, you can select the F10 key to drop into DOS; the F8 key brings in a terminal emu-

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■ MULTIPLEX

Column Window Inquiry Table Database Output Quit
Browse the contents of the active window

MAIN	order_nr	ord_date	cust_nr	ord_amount	req_date	salesr	office	comment
1	7435943	10/20/84	5050	3456.98	11/30/84	300	302	
2	4738302	10/13/84	5030	67000.00	12/30/84	400	302	
3	4734042	12/13/84	5010	50000.00	01/21/85	300	105	Replace
4	6745403	10/15/84	5010	8750.46	11/15/84	1100	302	
5	5483782	11/15/84	5450	6575.00	01/15/85	1300	110	Initial
6	5847394	12/10/84	5500	11450.75	02/01/85	1500	220	Qty 500
7	4538473	01/01/85	5030	985.75	02/01/85	1700	220	
8	1233738	01/01/85	5040	35000.00	03/15/85	300	105	Region
9	1233738	11/20/84	5000	22350.00	11/30/84	1700	220	RUSH!!!
10	2337493	11/15/84	5500	2350.00	01/15/85	800	210	
11	3846739	01/05/85	5000	2956.84	02/02/85	700	220	Closeo
12	1028392	12/10/84	5127	23450.00	02/15/85	600	210	Special
13	3045393	11/15/84	5500	250.87	11/19/84	1500	210	Credit/
14	4583946	10/25/84	5500	4503.74	11/15/84	1400	210	
15	6937465	12/05/84	5100	120000.00	02/28/85	300	105	Region
16	3647384	01/05/85	5100	56784.56	02/05/85	1000	301	New Div
17	1938284	11/25/84	5090	245.67	12/15/84	1800	220	
18	3047384	11/15/84	5020	2468.74	12/15/84	800	210	

The Multiplex program enters the data dictionary of the host DBMS and presents the PC user with an image of how the database is constructed. The PC can be used to browse through the structure of the tables and fields in the database files.

Select file(s) to send:

PC Files in: c:\nimpx				
AUTO123.WKS	CUSTLIST.MAC	CUSTLIST.TPL	CUSTLIST.TXT	DATA.WKS
DE.BAT	FILE.BAT	FRANK.MAC	MPX.CAP	MPX.EXE
TRX.MLP	MPX.OWL	ROSTER.TPL	SALESRPT.MAC	SCREEN01.CAP
SALESRPT.WKS	SCREEN00.CAP	SCREEN01.CAP	SCREEN02.CAP	SCREEN03.CAP
SLSD0101.MAC	SLSD0102.MAC	TE.BAT	TITLE.MAC	VT100.MPF
WIDEN.MAC				

Host Files in: /user/mpx/demo			
customer.h	customer.q	ddllockfile	errlog
field.tbl	file.db	file.dbr	file.h
lockfile	mpx.exe	mpxdemo.dbs	mpxdemo.dbs.11
offices.h	offices.q	orders.h	orders.q
patch.bas	roster.tpl	salesrpt.mac	salesrpt.tpl
staff.h	staff.q	unify.db	

The file manager supports PC and host file management and also makes it easy to transfer text and binary files between the systems. This screen shows three files on the PC selected to be transferred to the host. Wildcard matching for file transfers is also supported.

lation program for direct communications with the host. F1 calls up a full screen of context-sensitive help.

During terminal emulation, Multiplex operates like a DEC VT-102 terminal, but emulation of the newer VT-220 terminal is

■ With Multiplex, while a PC-to-host session is running, you can select the F10 key to drop into DOS.

not available. A menu lets you change the keyboard to enter single-key macros that you can use for host links. A full menu of options allows you to select printers and to perform file capture and transfer during the terminal emulation session.

Multiplex is sold through hardware manufacturers such as Altos, Convergent Technologies, NCR, Motorola, and Plex-us, and it is available from Relational Technology and Unify. When you order, you must specify the host hardware and operating system you want to use it on. You also need to confirm that Multiplex supports the host DBMS you intend to use.

Pricing varies with the size of the host system. If the host is a PC AT running the Xenix operating system, the Multiplex package costs \$695 for the complete host and workstation package. The package for a MicroVAX II is \$3,000 for the host software and an unlimited number of stations.

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Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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Rx FOR SLIPPED DISKS

Disk drive utilities can tell you how healthy your storage system is and warn you when a crash is imminent. Here, 14 utilities to monitor disks and diagnose problems.

The biggest problem with DOS is that it is exactly what it purports to be, a disk operating system and nothing else. With none of the delusions of grandeur that haunt so many software packages, DOS makes no pretenses of stepping beyond its self-defined operating bounds into the realm of disk installation, maintenance, or diagnostics.

For everyday chores, DOS certainly has what it takes—you can create, copy, delete, and rename all the files you want. You can partition and format disks. But when you suspect a problem in your mass storage system, when you want to be certain everything is working properly, or you want to add a new drive or customize your system so that it perfectly matches your needs, you'll need more than DOS.

Where DOS fears to tread, however, third-party vendors run rampant. A whole body of software is available for easing the process of disk installation and diagnosing disk problems.

These programs are designed to give the advanced user intimate control over many of the functions forbidden by the

limited design of DOS. Some of them even extend those capabilities, such as the installation of a virgin hard disk, to the realm of the novice. Although definitely not for everyone, this software may be exactly what you need to get a hard or floppy disk drive up and running—or to keep it exactly that way.

If you want to follow the official IBM scheme for installing a hard disk from scratch, DOS is not enough. To initialize or low-level format a blank hard disk, you'll need IBM's Advanced Diagnostics disk, part of its *Hardware Maintenance and Service* package. Advanced Diagnostics also includes disk and system tests and can perform a surface analysis of a hard disk to locate bad sectors.

Although Advanced Diagnostics allows you to change the sector interleave of the low-level format you make in order to optimize disk performance, that's where its versatility ends. You cannot customize sector sizes, nor can you make any provisions whatsoever for adding nonstandard disk drives (those not supported by the controller of your XT firmware or the set-

■ DISK DRIVE UTILITIES

up menu of your AT) to your system.

(Used on the AT, Advanced Diagnostics will only recognize, test, and format the number of cylinders and heads indicated by the SETUP procedure. Although you can successfully use a drive configuration not listed in the SETUP table by indicating a SETUP configuration that has fewer heads and cylinders than the drive you want to install, you end up wasting disk space because the unindicated disk areas cannot be used by the computer.)

Although menu driven, the Advanced Diagnostics software is not the most convivial program in the world, perhaps because it's aimed mostly at dealers and service people.

Third-party software vendors offer a variety of disk installation aids to make up for those shortcomings or sidestep the cost of Advanced Diagnostics. Their products range from those that try to cover all the bases to simple packages of individual features that might make desirable additions to your system.

AUTOMATIC INSTALLATION If computers are something that you would rather spend your time using than setting up, automatic installation programs such as Ontrack Computer Systems' *Disk Manager* or Storage Dimensions' *SpeedStar* will appeal to you. They can make the most difficult hard disk installation almost trivial. Buy a new bare drive from the lowest-priced mail-order supplier, plug it into a mounting bay in your computer, and slide the software installation disk into drive A:. Type a single instruction such as **INSTALL**, pour yourself a mug of java, and never worry about cylinders, precompensation, or poltergeists again.

Slightly more complex to use and slightly more versatile, Golden Bow Systems' *Vfeature Deluxe* will also initialize hard disks from low-level to DOS formatting, as well as provide a number of security options.

Don't think that just because you can run SETUP blindfolded with one arm tied behind your back, you shouldn't consider this drive enhancement software—built-in customization options in these programs can help you wring the last scintilla of performance from your hard disk. These third-party disk initialization packages can

help your system reach every last head and cylinder of almost any disk drive, regardless of whether its precise configuration is listed in the SETUP list, and can make all that space available for storage.

In addition, like Advanced Diagnostics, these utilities offer you the option of altering the sector interleave. In fact, HOP-timum, part of the Kolod Research *H-Test/Hformat* package, will even help you determine which sector interleave will deliver the best performance with your system and disk drive.

Some of these initialization utilities will also permit you to define sector or cluster sizes to extend capacity beyond the 32 megabytes ordained by the DOS standard. Some software will even let you logically

■ **Most diagnostic software will perform a simple read test and run the head mechanism through its paces to assure all is well.**

link several partitions or even physical disks into a single drive letter, making two or more drives work like one much larger unit so you can store huge files, hundreds of megabyte long. You can make your disk drive work the way that you want it to, not the way that DOS lets you.

OXIDE PARACHUTES A doubtful disk will give you the same security you'd feel when you're skydiving and your ripcord rips off without releasing the parachute. For a few delightful minutes of freefall you think you're safe, but the sudden failure can leave you flat. Similarly, the typical disk drive will work fine until fate finally catches up with it, giving you no indication of the impending disaster.

Although DOS alone won't predict or forestall such calamities, both IBM's Advanced Diagnostics and third-party software provide a wide selection of diagnos-

tic programs that can help. Using these facilities, you can verify that your hard disk drive is operating properly and that every flux cell on its surfaces is ready and able to store your data.

This software can be divided into two types: before-the-format integrity tests and after-the-format assurance evaluations.

The before-format tests check for bad spots on the disk and prevent them from ever being used for data storage. In most cases these tests are destructive, involving the writing of one or more sectors or tracks to the disk, then reading them back to ensure that what was put down comes back. This write/read approach is the most thorough way of testing a disk. Don't run these tests on a disk that contains valuable information.

Many packages offer this facility as part of their format procedures. Others, such as *HTest/Hformat* and Advanced Diagnostics, break out these procedures from the format process.

Obviously, however, writing across all of the surfaces of the disk is just as destructive as a format, and will have a deleterious effect on the material previously stored on the disk. Even when it's used without the low-level format procedure, you won't want to use such a program after your disk has been in use for a while—unless you're willing to go through the backup and restore process. However, if you suspect damage from a head crash or similar disaster, you'll have to go this route.

Most diagnostic software packages will also perform a simple read test and run the disk drive head mechanism through its paces to assure that all is well (the seek test). These procedures will help you detect potential dangers without overwriting your important data.

The best-known—and perhaps most widely used—of the read-only tests is the DT (or DiskTest) portion of *The Norton Utilities*. DT is highly regarded in the hard disk industry as being better than DOS at finding marginal disk sectors. It does not, however, evaluate the performance of the head mechanism.

Version 4.0 of the *Norton* package not only locates bad clusters and allows you to lock them away from DOS's use, but it will also attempt to recover information stored on sectors gone bad and will even

FORMATTING BASICS: HOW TO GET A DISK READY FOR ACTION

Probably the least excusable oversight in PC-DOS is its inability to take a hard disk drive from the perfectly blank condition as delivered by the original manufacturer and make it into a useful mass storage system running under DOS—in other words, to initialize it. The omission is inexcusable because many versions of MS-DOS include what PC-DOS lacks.

Initialization is necessary unless you buy a complete disk drive package and pay the package price (which often is substantially more than the cost of buying a hard disk alone). While IBM supplies its own hard disks already initialized and most reputable mail-order suppliers will include the required software with the products they send you, initialization is sometimes still necessary.

For instance, you may be tempted by a low price to buy a drive directly from its manufacturer, an electronics distributor, or a surplus dealer. Or you may have had a minor disaster with your existing hard disk and want to re-initialize it to eliminate disk errors or just get it going again.

The most important part of disk initialization is the low-level format.

Most new PC users are surprised that hard disks require two kinds of formatting—low-level and DOS—and that PC-DOS can't do the low-level format.

But low-level formatting is not the only step involved in initializing a hard disk. A new hard disk also requires matching its physical parameters (the number of heads and cylinders it uses) to one of the host computer's setup options, partitioning, and special device drivers to make all its capacity useful.

The difficulty of matching a hard disk to its host computer varies with the type of system involved. With the AT and common disk drives, harmonizing the disk drive with the system is simply a matter of selecting the correct drive type number using your computer's SETUP program—if you know the drive type and

if its essential parameters are among those supported by the SETUP facility.

With XT-like systems, matching the hardware is more difficult. The drive specifications of a hard disk to the host system are normally defined by firmware, usually ROM chips on the controller card. The firmware must match the drive you want to use or you'll have little chance of making a successful installation.

A few controller manufacturers make provisions for a variety of drives through clever drive-loadable drivers. Because these systems include their own setup software, they eliminate much of the need for add-on installation programs.

LOW-LEVEL FORMAT Once the drive and system are properly matched, the disk platters must have a low-level format installed. The low-level format is a set of magnetically recorded pulses on the disk that actually define where disk tracks and sectors are located. This information designates frames on the disk where data will be stored. The drive controller hardware uses the low-level format information to find each sector under the control of DOS.

The low-level formatting process is a bit more complex than just writing to disk, and it involves several decisions. Part of the process involves marking defective disk areas so that they are not used for data storage.

Usually low-level format procedures will locate most of these defective areas by writing across the entire disk surface, then reading back to find errors. Some low-level format programs may rely on you to type in bad track data, which is usually supplied by the disk manufacturers (as a list taped to the drive itself) or found through a separate disk "surface analysis" procedure.

The low-level format of a disk drive also determines its sector interleave, which can have a big effect on overall

disk performance, and its sector size, which can affect the useful capacity of a disk and how the disk is dealt with by the operating system.

Once a disk is low-level formatted, it must be partitioned, which puts the next layer of logical structure on the disk, the disk partition table. The partition table indicates the size and configuration of a hard disk to the host computer. The partition table can even indicate that the PC should treat a single physical disk drive as several different logical drive units, each with its own drive letter designation.

Partitioning is the first step of the initialization process that PC-DOS supports. The utility called FDISK builds the disk partition table.

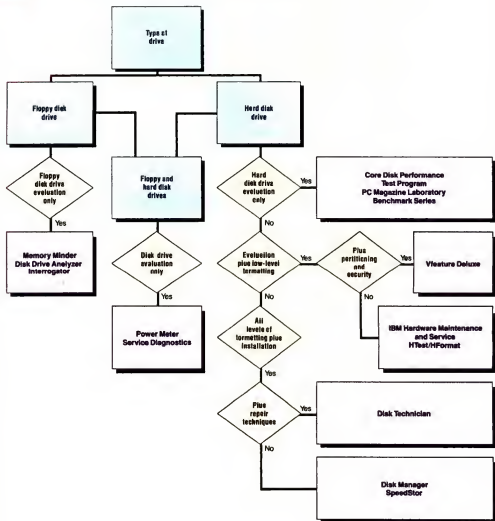
In most versions of DOS, FDISK allows the disk to be subdivided into as many as four partitions. Each of the four must use a different operating system, so you can only create one DOS partition per drive using FDISK. Third-party software often allows dividing a single disk into multiple DOS partitions, as does PC-DOS, Version 3.3.

After the partition table is set up, the new disk requires DOS formatting. The DOS format procedure sets up the directory and file allocation table (FAT) structure of the disk. Sectors are grouped together as clusters, each one of which is assigned a number. DOS deals only with cluster numbers and does not worry about the low-level format, sectors, and so on.

The DOS FORMAT program allows for only a few tightly defined disk arrangements. For instance, the root directory of the drive has enough space for only 512 entries. Similarly, a limited amount of space is allowed for the file allocation table, and this limitation ultimately prevents unadorned DOS from working with disks larger than 32 megabytes. Third-party programs can break through these barriers and allow you to customize your disk to best suit your data storage needs.—Winn L. Rosch



Evaluating Your Drive Analysis and Maintenance Needs



■ DISK DRIVE UTILITIES

mark bad sectors as good, just in case you like to play with fire.

Because DT is nondestructive, you can run it on a nearly full disk and never risk a byte. It carefully scrutinizes each disk sector and ensures that its data matches the cy-

■ HTest/HFormat

combines its read test with enough head-jostling to make it the most elaborate of the nondestructive disk evaluation programs.

clie redundancy code contained on the disk. It's both fast and easy to use (merely typing DT will suffice to get you started). The vendors of even top-quality disk drives recommend regularly running DT (monthly will probably suffice) to ensure the integrity of your data.

Disk Manager Diagnostics, from On-track Computer Systems, includes as one of its disk integrity checks a utility that functions much like DT. In addition, the program package allows you to test the mechanical aspects of your hard disk drives.

Disk Technician, a new program from Prime Solutions, promises to be even more thorough than DT by peering deeper into system hardware. Although nondestructive, it will perform read and write tests and even reformat tracks as necessary to avoid errors. (It copies disk data to memory before writing to disk, then copies the data back when it's done.)

Most disk initialization software packages—including Advanced Diagnostics, *Disk Manager*, *SpeedStor*, and *Vfeature*—will also perform seek tests to evaluate the performance of disk drive head mechanisms. *HTest/HFormat* combines its read test with enough head-jostling to make it the most elaborate of these nondestructive disk evaluation programs.

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■ DISK DRIVE UTILITIES

which parallels the abilities of the *IBM Hardware Maintenance and Service* utilities to evaluate the overall health of personal computers, also includes hard disk read and write tests.

PERFORMANCE TESTS Diagnostics are not the only tests that you may want to administer to your mass storage system. For instance, you may want to compare its performance with that of other systems

(for instance, to see if you really need to upgrade to something faster) or you may want to test the system every few months to determine whether something has degraded or gone awry with heavy use.

Alas, you can't just look at a hard disk drive and tell how good it is. Manufacturers have cleverly locked the platters and the all-important head mechanism inside a hermetically sealed chamber. Pry it open to take a look, and your warranty flutters away into the wind.

DOS doesn't help out at all in evaluating disk drive performance. To your operating system all disks are alike, whether they fetch bytes with blinding speed or lollygag along the way. You can tell the difference between a fast and slow drive when you unleash a sort on your biggest database, but in the store (or wherever you're called upon to make a judgment) you're unlikely to have any means of measuring the performance of a disk drive.

Three tools that will help you judge the performance of disk drives, as well as other aspects of your system, are Core International's *Core Disk Performance Test Program* (or *Coretest*), *Power Meter* from Power Systems, and our own *PC Magazine Laboratory Benchmark Series*. These programs help you compare your equipment with whatever else is available and to monitor its performance over time. The prowess of *Coretest* is limited to evaluat-

■ Alas, you can't just look at a hard disk drive and tell how good it is. Pry open its sealed chamber, and your warranty flutters away.

ing the two most important hard disk parameters, access speed and data transfer rate. The PC Labs benchmark tests and *Power Meter* measure all aspects of system performance. *Power Meter* will even set up and manage a database of disk

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drives and entire computer systems so you can make quick comparisons of the products you've played with.

FLOPPY PROBLEM Floppy as well as hard disks are apt to develop problems. In fact, floppies are more likely to be troublesome because the disks are used in different drives. Ensuring this interchangeability requires that every floppy disk drive be precisely aligned to industry standards and that it maintain that alignment.

A hard disk reads the same disk that it writes (using the same head) and consequently has no head alignment problems. Floppy disks, on the other hand, are likely to be swapped between drives and even computer systems. How well they work (if at all) inside various drives depends on the drives being adjusted to the same stan-

■ When problems arise, all too often the jack-of-all-trades DOS is more like a Swiss Army knife without a pen blade.

dards: head alignment, speed, and so on. All of these alignments deteriorate with time and use.

Ordinarily you won't notice the subtle, continual degradation of the performance of a floppy disk drive. A floppy either works or doesn't work. And when it doesn't work, you'll know it, though you'll have little hint of why.

Several manufacturers offer test programs for floppy disk drives that allow you to check their critical operating parameters and (should you have the right tools and hardware manuals) help you adjust the drive mechanism for correct operation. Among the products currently available are Xidex Corp.'s *Interrogator*, *Memory Minder* from J&M Systems, and Verbatim Corp.'s *Disk Drive Analyzer*. SuperSoft's *Service Diagnostics* also includes floppy read and write tests and, optionally, floppy disk alignment tests.

These programs all work similarly. Usually they include a specially written floppy disk with precision magnetic patterns that can be used to measure critical disk drive alignments. A second floppy disk holds a control program that runs the alignment disk through its paces and presents you with the results. The Verbatim system combines the program and alignment disks.

Floppy disk tests can be either automatic or manual. Automatic test procedures—used by Verbatim's *Disk Drive Analyzer* and the auto-sequencing section of Xidex's *Interrogator*—make a fast go/no-go evaluation of the drive by quickly running through a complete series of analyses. Manual evaluation procedures let you choose the individual test to run and how long to run it. The results are presented in numeric or graphic form, allowing you to make fine judgments about the drive.

Although the auto-sequencing section of *Interrogator* is not quite as easy to use as the one in *Disk Drive Analyzer* (*Interrogator* requires the use of two disks), it is more thorough and allows you to set its pass/fail limits.

The accuracy and reliability of *Interrogator* and *Memory Minder* are almost exactly comparable, primarily because both use the same Digital Diagnostic Disks. *Interrogator* is more thorough, but some may prefer the the graph-oriented interface of *Memory Minder*, particularly when adjusting or repairing disk drives.

Without a doubt, DOS is a carefully crafted, well-thought-out tool that opens the door to the widest software library in the world. But all too often, when problems arise or your needs stray too far from the 40 beaten tracks of your floppy disk, you find that the jack-of-all-trades DOS is more like a Swiss Army knife without a pen blade.

In many ways, these programs that go beyond DOS have limited appeal. For example, you need a low-level format program only if you have a truly blank new disk or suspect the worst has befallen one that you already have. Diagnostics reveal many secrets that you may not be able to do anything about. Yet if you're serious about your personal computer, you'll probably want to have one or more of these programs in your library.

Disk Initialization Programs

Disk Manager/ Disk Manager Diagnostics

Disk Manager automates and extends normal disk initialization procedures. Besides merely laying a low-level format on a hard disk, it also allows you to create partitions with capacities of up to 512 megabytes or up to 16 partitions per physical drive with up to four different operating systems. It also allows you to select the sector interleave and even mark partitions as read-only, a useful security feature for important data.

Ontrack Computer Systems claims its *Disk Manager* is compatible with all ST506/412 interface hard disks—even those with head and cylinder counts not supported by SETUP—and handles RLL (Run Length Limited) without a problem.

Disk Manager allows larger partitions by increasing the disk sector size. It also allows the selection of the number of entries that will fit in the root directory.

It copes with odd disks with a special



EDITOR'S CHOICE

FACT FILE



► *Disk Manager Diagnostics*
Ontrack Computer Systems
6222 Bury Dr
Eden Prairie, MN 55344
(612) 937-1107

List Price: *Disk Manager*, \$49.95; *Disk Manager Diagnostics* \$124.95.
Requires: 2K RAM (*Disk Manager*), 3K RAM (*Disk Manager Diagnostics*), one floppy disk drive, DOS 2.0 to 3.3.

In Short: *Disk Manager* automatically sets up any AT and many XT hard disks from low-level to DOS formatting with almost no user intervention. Allows multiple DOS partitions and partitions larger than 32 Mbytes. *Disk Manager Diagnostics* is a hard disk media and drive evaluation program that performs several tests, including both destructive and nondestructive media tests and seek tests. Not copy protected.

CIRCLE 633 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

device driver that loads new parameters into the drive definition table when the host computer is booted.

The flexibility of *Disk Manager* is welcome and may be helpful to experienced users who want to use strange storage devices. But it can also be used as an automatic installation program for neophyte users.

Automatic installation, the preferred operating mode, is a breeze. Start *Disk Manager* and the program will ask you to choose the drive manufacturer's name from a menu. Next, the *Disk Manager* queries you as to the model number. You're given a chance to type in a defect list and one last chance to abort. From then on, installation is entirely automatic.

Once the disk is formatted, you'll need to do a little floppy disk shuffling to allow the *Disk Manager* to copy system files from your boot floppy.

With disks under 32 megabytes, the default configuration set up by *Disk Manager* is somewhat unusual: two partitions, one of minimum size and another that consumes the rest of the disk. This arrangement allows *Disk Manager* to grant your system one entirely standard (although small) DOS partition to boot with, and a second, somewhat strange (but, of course, entirely workable) partition optimized to your own idiosyncrasies.

Select manual installation by starting the program with the parameter /m on the command line, and you can take intimate control over drive parameters. This option allows you to limit low-level formatting to a single track, one partition, or the entire disk. You can also choose an interleave value of your own liking, with the IBM standard of six being the default for PCs, three for ATs.

In manual mode, *Disk Manager* allows you to alter a variety of disk operating parameters, including the number of cylinders, heads, ECC protection span, the standard time out, format time out, check drive time out, landing zone, number of sectors per track, reserved bytes, where to reduce write current, and where to use write precompensation.

The companion program, *Disk Manager Diagnostics* (available separately and in conjunction with *Disk Manager*), includes such media and drive quality evaluation

features as controller tests, seek tests that seem to really exercise the drive, and random read tests. The system also performs read/write tests but commendably forces you to set the system manually to enable writing to disk and provides fail-safe warnings so that you don't inadvertently blow away your data.

While full surface evaluation is handled

■ The flexibility of *Disk Manager* may be helpful to users who want to use strange storage devices.

automatically at format time, it can also be later run through *Diagnostics*. In addition, *Diagnostics* will perform a read-only media integrity test, much like Norton's DT.

Some compatibility bugs appeared with some of the weird and unusual devices we tried the *Disk Manager* programs on. For instance, although *Disk Manager* purports to operate with a wide variety of hardware, we encountered difficulties using a Priam hard disk and Western Digital controller as well as a hardware-based hard disk simulator. In both cases, the test system froze and required a cold boot to get back into action.

The system also has documented inconsistencies with Epson Equity III and AT&T PC 6300 Plus systems, but it provides special instructions for such installations. In more normal disk environments and with disks of the type you're likely to need to install, the program worked its magic flawlessly.

Disk Technician

Imagine a snake-oil peddler dispensing penicillin and you'll have a good feel for Prime Solutions' *Disk Technician*. Wade through the company's propaganda, and skepticism is the most favorable reaction you're likely to have. The literature makes the doomsayers of Delphi sound more optimistic than Jiminy Cricket while promising bigger miracles than splitting apart the Red Sea.

But beneath all the verbiage is a hard disk diagnostic and repair program that may just save you from disaster—if you can endure the petty demands of regularly putting it to use.

Disk Technician promises to test your hard disk better than any other product and actually second-guesses the equipment that hard disk manufacturers use for testing their media.

It's more sensitive than other diagnostic programs because it slips in and monitors disk quality between the disk controller and the disk itself. While *Disk Technician* listens to the raw data read from the disk, similar programs monitor the signals only after they've gone through at least one degree of error correction—or so explains Prime Solutions.

The program will naturally observe more errors. However, instead of simply letting your system correct them, *Disk Technician* keeps track of each misread so that it can separate truly random events from repetitive ones that may hint at potential media failures.

When the program identifies a disk cluster as doubtful, it memorizes all the information on the track containing that sector, reformats the track, retests it, and, if the situation improves, copies back the data. If the cluster is truly going bad, *Disk Technician* finds a new home for the information before it's destroyed. The program can thus prevent errors from happening, a



FACT FILE



Disk Technician
Prime Solutions Inc.
1940 Garnet Ave.
San Diego, CA 92109
(619) 274-5000
List Price: \$99.95
Requires: 256K RAM,
hard disk drive, DOS 2.1

or later.

In Short: A disk maintenance, testing, and repair program that checks for impending bad sectors and moves data to safe areas with data loss. Hindered by inadequate and misleading documentation as well as use limitations that effectively function as copy protection.

Copy protected.

CIRCLE 68 ON READER SERVICE CARD

■ **When Disk Technician** was tried on a disk with many known bad sectors, it located them all and freed up several hundred extra kilobytes.

truly commendable idea, I might add.

Disk Technician works on individual clusters and marks them bad while most manufacturers' surface analysis software usually writes off a whole track when it contains but one bad bit. Consequently, *Disk Technician* can cram more data onto disks that were manufactured having many media errors. In fact, when *Disk Technician* was tried on a disk with many known bad sectors, it located them all and freed up several hundred extra kilobytes with no apparent problems.

The program has its downside, however. For the most protection from disk failures, it must be used daily. Fortunately, Prime Solutions has made that chore more endurable by designing the program to automatically select one of three modes: daily, weekly, or monthly maintenance. The modes vary both in thoroughness and in time required—from a few minutes every day to a few hours every month.

But *Disk Technician* must be run from a floppy disk. According to Prime Solutions, the distribution floppy is not copy protected, but it contains some special calibration tracks that cannot be duplicated. If that's not a big enough insult (both to your honesty and your intelligence—because it sure seems to work like copy protection), each copy of the \$100 program adds identifying marks to the first hard disk with which it is used and thereafter works with no other hard disk. That's right, you'll have to buy another copy of *Disk Technician* if you've got two hard disks connected to your PC.

Disk Technician essentially ignores DOS and takes direct hardware control,

which restricts its compatibility somewhat. It works with most IBM controllers and many clone computers. It will not work with hard disks that use software device drivers.

Although the program claims to use artificial intelligence, it does so only if you use the broadest possible definition of the term: it merely uses a decision tree (if-then logic) and a database. The manufacturer

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THE RESEARCH GROUP

CIRCLE 111 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

refuses to disclose how the program works, so many other claims made for the program cannot be confirmed.

In effect, *Disk Technician* is a black box in which you're asked to put explicit trust based on misleading claims. It's a workable product plagued by doubtful marketing practices.

IBM Hardware Maintenance and Service

For the most part, IBM's maintenance and service manuals and their associated software tell you what you already suspected and didn't really want to know—your system has a problem, probably one you cannot fix yourself. These products are designed to aid dealers in making their diagnosis of your hardware (and your wallet), but you can use them too.

One of the most important parts of the package is its Advanced Diagnostics disk, a set of test routines that check every aspect of your system, from keyboard to video display. One run-through of Advanced Diagnostics should show what ails your computer, narrowing it down only slightly to the disfunctional module (is it any better to know you have a defunct system board instead of just a dead PC?).

Hidden deep down in the simple menuing interface of the Advanced Diagnostics program are what may be its most important features (at least if you have a brand new disk drive), its hard disk formatting

and surface analysis routines.

The low-level format procedure uses the head and cylinder parameters selected with the SETUP program, to apply a quick low-level format to any compatible disk. The interleave used in the formatting is programmable but automatically defaults to IBM's preferred values.

At the same menu that starts the format process, you also have your choice of surface analysis. IBM's program for finding bad sectors. The procedure is destructive, so it cannot be used instead of one of the read-only tests to check for disk degradation. However, it is effective and thorough.

As it scans the disk, this routine dis-

■ A nagging question is why IBM's disk initialization procedure costs extra, when other hardware manufacturers include similar utilities free of charge.

plays each bad spot it finds, indicating the head number, cylinder, and sector. This makes head-crash damage immediately apparent and gives numbers that can be directly entered into format programs that require manual entry of bad track data. Other, similar diagnostic programs may merely indicate the cluster numbers where errors occur, which makes possible physical problems less apparent.

In past years, IBM has offered individual *Hardware Maintenance and Service* packages for each PC model—from the PCjr to the AT—each package including everything you need to evaluate all official IBM components of that computer model, including special connectors to test system ports. If you had a PC and an AT, you needed to purchase two different packages.

Recently this venerable and expensive

series of service products was superseded by one overall package, IBM's part number 6280087, priced at \$195.

The new comprehensive service package may be difficult to find and buy, however. We were unable to acquire one after surveying several dealers and even IBM's direct sales line. Although we were assured the new overall service package does, in fact, exist, the description in this story is based on the older, more obtainable individual *Hardware Maintenance and Service* packages.

In any case, the programs supplied with the service packages operate independently of DOS and must be booted and run from floppy disk. They are thus incompatible with non-IBM hard disks that use software-loaded device drivers. Fortunately, few such drives are sold any more.

The user interface is primitive, a black-and-white, text-only, simple series of menus designed to be equally appropriate for 40- or 80-column displays. Although getting to the hard disk format and disk testing procedures is circuitous, once you know your way through the menus you won't have difficulty.

When you use Advanced Diagnostics with the DOS 3.3 FDISK program and a disk drive fully supported in the SETUP listing, you should have no need for third-party software. In addition, the new PC-DOS 3.3 FDISK will create multiple DOS volumes that do not require software drivers loaded from disk through CONFIG.SYS. With some persnickety programs that dip below DOS (such as a few backup systems), this method is preferable because additional volumes appear more like additional physical drives.

A nagging question is why IBM makes its disk initialization procedure an extra-price add-on available only with the *Hardware Maintenance and Service* package while other manufacturers include similar utilities with their products. Perhaps the best reason is to keep these powerful and dangerous functions out of the hands of Looney-Tunes types who are likely to do more harm than good. For our part, we can't imagine getting along without Advanced Diagnostics or the *Hardware Maintenance and Service* package. Then again, we low-level format one or more hard disks almost every week.

**FACT FILE**

**IBM Hardware Maintenance and Service**
IBM Corp.
Contact your local IBM dealer.
List Price: \$195
Requires: Varies with PC model.

In Short: The official Big Blue way to check your computer and its IBM peripherals for malfunctions, locate failures, and low-level format your hard disk. Copy protected.

CHILL: \$35 (ON READER SERVICE CARD)

HTest/HFormat

HFormat, from Kolod Research, is a low-level disk formatting program designed to accommodate any disk drive and controller you can plug into your PC or AT. It allows you to low-level format your drive with any interleave that will work. In addition, it allows you to low-level format a drive with more cylinders or heads than DOS or your controller permits.

Despite this formatting, however, the additional disk space will not be addressable by DOS unless you modify your system. Alternately, with **HFormat** you can low-level format only part of a disk, all the way down to a single track.

To use **HFormat** with a drive whose parameters differ from those supposed by the SETUP procedure, you'll need to know the head and cylinder arrangement of the disk drive. **HFormat** does not recognize drives by make and model number.

HFormat can be used instead of IBM's Advanced Diagnostics to ready a hard disk for partitioning with FDISK. Although **HFormat** is more versatile (and less expensive) than IBM's product, the IBM procedure is easier to use.

A companion program, **HTest**, allows you to check the results of the disk formatting. Compared with other disk testing programs, **HTest** is extremely thorough, starting where others (such as Norton's DT) leave off. Options available for read-

only testing skew the head across the disk in various patterns to ensure proper operation of the head actuating system as well as the disk surface itself.

HTest also includes destructive read/

write tests that start with the equivalent of IBM's surface analysis procedure then venture on to the head-jerking rigors of its own read tests.

HTest's thoroughness slows it down.

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HTest/HFormat

Kolod Research
P.O. Box 68
Glenview, IL 60025
(312) 291-1586
List Price: \$89.95
Requires: 64K RAM,
hard disk drive, DOS 1.1

or later.

In Short: Utilities for low-level formatting, surface analysis, and drive evaluation most amenable to manual control. The drive tests are extremely rigorous. Includes HOptimum, a program that helps determine the sector interleave that delivers the best hard disk performance. Not copy protected.

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■ DISK DRIVE UTILITIES

Even using the fastest test option (Quick, Read-only), it can take over an hour to examine a 32-megabyte volume.

The Kolod programs work only with firmware-defined disk drivers (disks with software-loaded drivers need not apply) and recognize a maximum of two hard disk drives.

The best part of the Kolod package is HOptimum, a unique testing utility that

■ If you want to wring the last iota of performance from your drive, HOptimum will help you determine the best interleave factor quickly and easily.

can determine the optimum sector interleave for any hard disk-PC combination.

HOptimum works quite simply. After it loads, it displays a list of disk parameters as if it is about to low-level format the disk and gives you a chance to alter them. It then warns you that it is a destructive test that will overwrite data and gives you a couple of chances to abort before it starts blasting bytes.

Thereafter, it quickly low-level formats a section of the hard disk using a specific interleave factor, then reads the area and displays the time that was required. It repeats the process seven times, stepping from interleaves of one to seven.

When HOptimum finishes, it displays a list of all the interleaves tried and the time required so that you can choose the fastest.

Overall, the formatting and testing portions of the Kolod package are effective if unremarkable. However, if you want to wring the last iota of performance from your hard disk drive, the HOptimum program will help you determine the best interleave factor quickly and easily. This one feature is the best recommendation of the package.

SpeedStor

If you have to make a hard disk drive and controller work together, *SpeedStor*, from Storage Dimensions, is a dream come true. Just run the program, pick out the drive by name from a menu, and with the press of a couple of buttons—and enough time to get a sandwich—your disk will be ready and waiting for your files. Low-level formatting, partitioning, and DOS formatting are all handled without your intervention or even attention.

But *SpeedStor* is a versatile installation program, too. It can arrange your disk in just about any configuration you want. Slice it into up to eight independent DOS partitions (up to 16 total partitions), each with its own drive letter designation, or mass together a huge disk—up to 320 megabytes—as a single DOS device.

With ATs, *SpeedStor* has no problem with drive configurations not accommodated by the host computer's SETUP listing and puts their full capacity to use. In fact, you needn't bother with SETUP at all when using *SpeedStor*. It selects and loads the appropriate drive type into CMOS memory itself.

To work on XTs, *SpeedStor* requires that your hard disk controller be properly configured and refers you to your controller manual to accomplish that end. For controllers that allow software configuration, *SpeedStor* provides a complementary automatic installation option.

Automatic installation is handled by a batch file appropriately called *INSTALL*. Once you start it and select the manufacturer and model of the hard disk you want to install from a moving-bar menu, the process is completely automatic. Drives under 32 megabytes are automatically made into one large DOS disk; larger disks are split into several approximately equal partitions.

The procedure ends by presenting you with a completely blank, DOS-formatted disk. You must run DOS's SYS program to transfer the operating system to it in order to make it bootable. A software driver is required for partitions beyond the first to be recognized. A separate program (supplied with *SpeedStor*) automatically creates the correct device driver.

Manual control is also menu driven. Two programs are provided, *HARD-
PREP*, the disk formatter, and *PARTED*, the partitioning program.

The low-level formatter also includes a controller test, seek tests, and read and write tests. Surface analysis is handled as part of the low-level format procedure or as a separate option.

Even with a RAM-based hard disk emulator, *SpeedStor* demonstrated no compatibility problems. In most cases, it should be the only program you need to get any hard disk working on your PC.


Service Diagnostics

Although it seems to aim at two disparate ends—being more thorough than *IBM Hardware Maintenance and Service* and being easier to use—*SuperSoft's Service Diagnostics* succeeds admirably. Unlike *IBM*, it will even evaluate many non-*IBM* peripherals and accessories.


As with the *IBM* diagnostics, the *SuperSoft* program is menu driven using stark, text-only screens. Before testing begins, *Service Diagnostics* checks what peripherals are installed and reports them on the screen. It also allows you to override its findings.

Once the list is supplied, your primary choices are threefold: running tests individually, a quick automatic run-through of all tests, and an in-depth automatic test procedure.

After you make your selections, you're

**EDITOR'S
CHOICE**

FACT FILE



SpeedStor
Storage Dimensions
981 University Ave.
Los Gatos, CA 95030
(408) 395-2688
List Price: \$99
Requires: 512K RAM,
hard disk drive, DOS 2.0
or later.

In Short: A program that automatically configures any AT and many XT hard disks from low-level to DOS formatting. Requires almost no user intervention, yet allows multiple DOS partitions and partitions larger than 32 Mbytes. Not copy protected.

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■ DISK DRIVE UTILITIES

again allowed several options—for instance, stopping upon the location of an error. You can also select to log both results and errors on a disk file or on paper. *Service Diagnostics* also allows you to set up your system for shipping by parking its hard disk heads.

Some of the *Service Diagnostics* tests, such as the keyboard and display tests, carry over the feel of the IBM diagnostics. But *Service Diagnostics* often gives more thorough answers, reporting apparent microprocessor operating speed and specific instructions that lead to failures.

In the area of disk testing, for example, beyond normal read and write testing, *Service Diagnostics* optionally includes floppy disk alignment tests using Xidex's Digital Diagnostic disks. Available alignment tests include spindle speed, centering, index timing, head positioner hysteresis (the ability to repeatedly find a track when seeking it from opposite directions) and linearity, and radial and azimuth alignments. Results are reported both on a pass/marginal/fail basis and quantitatively, as appropriate, but results are presented only as test.

The standard *Service Diagnostics* package also performs read and write tests on hard disks, but a low-level formatting procedure is optional.

Service Diagnostics also includes a separate program that performs elaborate memory tests. The simplest requires but a few minutes, while thorough testing can take all night. The procedures allow you to

determine not only margins or which chip is failing, but how and at what memory locations errors occur.

Testing of serial and parallel ports can be performed either with nothing attached to the system or with optional loop-back connectors (much like those supplied with *IBM Hardware Maintenance and Service*). Printer tests even include options for checking daisy wheel as well as dot matrix machines.

Although thin, the *Service Diagnostics* manual often presents more in-depth information than the thicker IBM service manuals. However, in some cases (hard disks evaluation, for instance) the documentation is inexplicably brief.

Service Diagnostics loads through DOS, and its two programs, *SERV* and *MEMORY*, can be backed up or transferred to hard disk. Its copy protection requires a key disk in drive A:, however. Different versions of the program are available for and required by 8088-, 80286-, and 80386-based computers as well as those not using DOS.

Although the base cost of the program is reasonable, adding all the available options drives the price up to nearly \$500. The various test procedures in *Service Diagnostics* are suitable to be used by dealers or service people to evaluate ailing computers, by manufacturers to test and burn in new systems, and by end users—even those who are relatively inexperienced—wishing to monitor the health of their computer systems.

ber of heads and cylinders to use from CMOS setup information (on ATs) or ROM (on XTs).

The program asks if you're sure you really want to low-level format your disk. Punch in "Y", and you're asked several more questions before formatting begins.

As with most low-level formatting programs, you're first given a chance to enter bad sector data and an opportunity to specify a sector interleave. As the formatting

■ Vfeature allows the installation of some unusual hard disk drives using XT-style controllers without modification.

progresses, any bad tracks that are discovered are displayed. At the end of formatting, you're given a second chance to enter bad tracks.

After you're finished with the low-level format or if you choose not to format when queried (and your disk already has its low-level format in place), you're confronted with a simple partitioning and security feature menu.



FACT FILE



Service Diagnostics
SuperSoft Inc.
510 W. Park
Champaign, IL 61820
(800) 762-6629
(217) 359-2112
List Price: \$195
Requires: 128K RAM,
one floppy disk drive, DOS 1.0 or later.

In Short: An aftermarket program package that locates failures in all parts of a computer system. Extra cost options allow floppy disk drive tests and low-level hard disk formatting. Copy protected.

CIRCLE 631 ON READER SERVICE CARD

Vfeature Deluxe

Vfeature Deluxe, from Golden Bow Systems, combines low-level formatting, advanced partitioning, and data security.

Among the program's more welcome features is the ability to add unusual disk drives to XT's without hardware modification. Among its worst is a disk-locking procedure that adds extra steps and confusion to using the product.

The disk preparation process is conducted by a single program, *VOL_DEF*, which takes a query-and-response approach to low-level formatting. After a copyright warning message, the program presents you with several questions about your hard disk drive. It ascertains the num-



FACT FILE



Vfeature Deluxe
Golden Bow Systems
2870 Fifth Ave. #201
San Diego, CA 92103
(619) 298-9349
List Price: \$120
Requires: 384K RAM,
hard disk drive, DOS 3.1
or later.

or later.

In Short: A program package primarily aimed at allowing more partitioning options than does IBM, including multiple DOS partitions, partitions larger than 32 Mbytes, and partitions made from linked drives. Also includes security, low-level formatting, and other utilities. Copy protected.

CIRCLE 629 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

One menu selection allows creation of disk partitions, another DOS-formats them, and a third shows what partitions have been defined.

As with the FDISK function of PC-DOS 3.3, *Vfeature* lets you pile on extra partitions up to disk capacity. *Vfeature*, however, allows partition size to exceed 32 megabytes. If you want, you can put all your bytes—up to 1 gigabyte—in one drive letter, or you can slice your system into up to 24 individual volumes.

In addition, *Vfeature* allows you to splice together two physical drives into a single logical unit accessed with a single DOS drive letter and allows you to control the size of disk clusters as 2, 4, 8, or 16 sectors.

Vfeature also gives you optional password security for the hard disk, floppies, or the system in general. You can also write-protect portions of your hard or floppy disks so you never have to worry about

inexperienced or angry users destroying important programs or databases.

The impregnability of these security features is doubtful, however, because we were able to crash the host system while trying to set a password.

Vfeature allows the installation of some unusual hard disk drives using XT-style controllers without hardware modification and disks not listed in the setup menu on the AT. These disks can use up to 16 heads and 1,024 cylinders. Due to limitations of the standard IBM PC-XT-controller, however, drives for pure IBM XT systems can use no more than eight heads. Moreover, embedded-servo and servo-wedge drives (for example, some CMI, Microscience, Tulin, and Quantum products) are not compatible with the standard XT controller and cannot be used.

Although somewhat regimented, *Vfeature* includes all the functions necessary to get a system running. Unfortunately, it is

made unduly cumbersome by its form of copy protection, which "locks" the master disk to a single style of controller before it can be used. No unlocking method is provided. In addition, the *Vfeature* version tested will not operate with PC DOS 3.3. Not that the program crashed with PC-DOS 3.3—it simply checked the DOS version number and refused to operate with one that it did not recognize. We had to pull out our aged version of 3.1 to get *Vfeature* to run through its paces.

Floppy Disk Diagnostics

Disk Drive Analyzer

Truly a product for the digital realm where everything is on-or-off, one-or-zero, or black-or-white, Verbatim Corp.'s *Disk Drive Analyzer* gives a quick test of standard floppy disk drives and simply reports their condition as good or bad. *Disk Drive*

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■ DISK DRIVE UTILITIES

■ *Disk Drive Analyzer* generates a single screen on which it lists results of each test.

Analyzer performs seven distinct tests on floppy disk drives, checking speed, noise tolerance, write/read performance, track alignment, head positioner backlash (accuracy), disk clamping (centering), and erase crosstalk.

Every time *Disk Drive Analyzer* (a .COM file) is loaded by simply typing DDA at the DOS prompt, all of these tests run quickly in sequence. The tests are not individually accessible. The entire test

procedure requires less than a minute.

The program generates a single screen on which it lists the results as each test is performed, keeping a total tally on-screen when it finishes. Results are listed as merely "PASSED!" or "FAILED!" for each test on each side of the drive.

If you need a hard copy report of the results, all you need to do is press Shift-PrtSc at the completion of the procedure.

Disk Drive Analyzer is not as thorough as other floppy disk drive testing programs. For instance, it checks alignment and noise tolerance (which other products may refer to as "sensitivity") on only one track on the disk. Other floppy diagnostics examine performance at various locations, generally at the outer and inner limits of head travel as well as near the center of the disk.

Nor are the results generated by *Disk Drive Analyzer* suitable for aligning a disk drive. The simple pass/fail analysis does

not provide any direction for head alignment or speed adjustment.

Verbatim supplies *Disk Drive Analyzer*



FACT FILE



Disk Drive Analyzer

Verbatim Corp.
1200 W.T. Harns Blvd.
Charlotte, NC 28213
(800) 538-8589
(704) 547-6500
List Price: \$39.95

Requires: 64K RAM,
one floppy disk drive, DOS 2.0 or later.

In Short: A floppy disk drive evaluation system that checks the mechanical performance of drives and reports its results in simple pass/fail format suitable for making quick tests of a large number of drives. Copy protected.

CIRCLE 626 ON READER SERVICE CARD



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CIRCLE 525 ON READER SERVICE CARD



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NETWORK  VERSION
CIRCLE 326 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

on a single floppy disk. Several of its tracks are recorded with precision test signals, so it cannot be duplicated using normal floppy disk drives. All tests, including the write test, are performed using the program disk as the test medium.

Obviously *Disk Drive Analyzer* is no substitute for more-complete drive analysis programs. However, it can complement one of these other products nicely. Its ease of use and quick, one-step test procedure make it a good candidate for monitoring drive performance, perhaps as part of a weekly or monthly maintenance schedule.

In two minutes, *Disk Drive Analyzer* will assure you that your floppy disk drives are operating within industry standards for interchangeability and data integrity. If a drive flunks out, more thorough (and time-consuming) evaluation with another product will help you home in on the problem and adjust or repair it.

Interrogator

A floppy disk drive evaluation system, Xidex Corp.'s *Interrogator* functions in either of two modes, an auto-sequencing pass/fail test of important floppy disk drive alignments or a manual evaluation of a single drive parameter. The former allows quick go/no-go checking of a questionable drive, perhaps as part of regular maintenance. The latter will help you critically evaluate a particular aspect of drive performance and even realign an ailing drive for proper operation.

Xidex (formerly Dysan) provides *Interrogator* as a two-disk package. The program itself is supplied on one disk, and a second disk containing precisely recorded signals is used as an evaluation standard called a Digital Diagnostic Diskette (DDD).

The program is quite short and loads in a few seconds, after which the program disk can then be removed and the DDD inserted.

Interrogator is menu driven and relies heavily on function keys for making the appropriate selections. A modest amount of on-screen help is available.

■ *Interrogator's* auto-sequencing test presents its results in chart form, listing a numeric qualification and a pass/fail indication.

The program disk is non-DOS and self-booting, and hence cannot be copied with the normal DOS COPY utility. Given the appropriate command, however, the program will generate a backup copy of itself. The DDD is made on special equipment and cannot be duplicated on standard floppy disk drives.

The DDD is available in IBM standard single- and double-sided, double-density 5¼-inch; high density 5¼-inch; and 135-track 3½-inch formats. Several formats not supported by IBM are also available.

The auto-sequencing test procedure of *Interrogator* presents its results in chart form, listing a numeric quantification of drive performance as well as a pass/fail indication. (The turnover point for the pass/fail judgment can be adjusted or customized using a setup procedure.)

The auto-sequencing tests include disk centering, radial alignment measurements at three different tracks, head azimuth, index time (how long it takes the drive to find a track after receiving an index pulse) to

two different tracks, and disk speed.

These same tests are available in manual mode, often presented in quasi-graphic form—a number line with a pointer generated in test mode—that allows the use of the *Interrogator* system in making drive alignments.

Alignment tests supported by *Interrogator* include disk speed, centering, radial and azimuth alignments, head index speed, and hysteresis.

Interrogator also performs a read/write test aimed at evaluating the overall performance of the disk drive, not the media. This test formats a user-supplied floppy disk with a special pattern. It then randomly writes to the disk and attempts to read it, reporting the location of any errors it encounters. This test will aid in zeroing in on where, when, and whether a problem is within a disk drive (or one side of a double-sided system) or somewhere else in the mass storage system.

In addition to reporting errors on screen, *Interrogator* will generate hard copy output and even allows you to select a serial or parallel printer port.

The *Interrogator* manual is clearly written and provides enough background to let you understand what each test does. It does not, however, offer instructions for aligning or repairing disk drives.

Memory Minder

When you suspect your floppy disk drives are getting forgetful, it's time to pull out J&M Systems' *Memory Minder*. A drive analysis program, *Memory Minder* will help you determine whether all's well with the mechanical parts of your floppy disk system.

Memory Minder checks all the important alignments of your computer's floppy disk drives, including disk centering, head azimuth, and spindle speed, as well as the ability of the drive to find each and every track. It does not check the integrity of the floppy disks themselves.

The program consists of two floppy disks and a manual in a folding plastic binder. One disk holds the *Memory Minder* disk itself. Although not truly copy protected, it's immune to the DOS COPY command because it operates independently of DOS and is not even DOS-for-

**FACT FILE**



Interrogator
Xidex Corp.
5100 Patrick Henry Dr.
Santa Clara, CA 95050
(408) 988-3472
List Price: \$139
Requires: 64K RAM,
one floppy disk drive

In Short: A hard drive test system that evaluates mechanical performance and drive alignments. Results are reported quantitatively, sometimes with text-mode graphics, allowing the program to be used in drive alignment. Copy protected.

CIRCLE 16 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

matted. You must boot from the *Memory Minder* disk to use the system.

The other disk is a specially recorded alignment disk made by Xidex Corp. This disk cannot be duplicated either, because its precision signals cannot be properly recorded by an ordinary disk drive.

Memory Minder is available in several formats: the standard 5¼-inch, double-density, double-sided (360K) disk; the 5¼-inch, high-density (AT-style, 1.2-megabyte) disk; or IBM's original 3½-inch, 700K-byte floppy disk formats.

After you boot up with the *Memory Minder* program disk in drive A:, you can put the disk away because the program itself stays in memory. Next you slide the Xidex alignment disk into the drive that you want to test.

Memory Minder is menu driven and initially gives you a selection of the tests that you can carry out. You can also select the disk drive to be tested and the head to be used. *Memory Minder* tests each head, corresponding to each side of a disk, separately.

Memory Minder's clamping test determines how close to perfectly centered your disk drive holds each floppy disk. The results of this test will give you an indication of the condition of the disk hub of the drive as well as the drive spindle and bearing assembly. This test must be run first because improper clamping affects other *Memory Minder* tests.

The spindle speed test reveals how fast floppies spin inside the drive. If they turn

too fast or too slow, the drive may not be able to read (or write) to them properly.

The alignment sensitivity test shows how tolerant a drive is to slight misalignment of its read/write heads. This test can indicate worn pressure pads, weak head read electronics, dirty heads—or a worn-out diagnostic disk!

The head alignment test quantifies how closely the head comes to perfect radial alignment, that is, how close it comes to

■ *Memory Minder* checks all the important alignments of your computer's floppy disk drives, including disk centering, head azimuth, and spindle speed.

being where it's supposed to be.

The head rotation test corresponds to the azimuth alignment of the head. This test reveals how nearly perpendicular to the tangent of each track the head gap comes. Rather than showing the number of degrees the gap is tilted, the test displays results in the number of errors made in reading on tracks recorded with different angular displacements.

The directional seek test shows how precisely and repeatedly the drive can move its heads to the correct track. This test gives an indication of how worn the head guides are.

All test results are presented in a text-mode graphic display that sometimes functions as a simple meter (spindle speed) and other times as a histogram showing the relative number of occurrences of a given reading.

Although the manual tells how to interpret these results, it only gives the vaguest hints at solving the underlying problems. However, with a disk drive service manual, *Memory Minder*, and sufficient intelligence to put both to use, you can make

routine adjustments to your floppy disk drives and bring marginal units back up to snuff. Odds are that's more than your dealer will do for you—standard dealer service on floppy drives is replacement.

If you are a tinkerer at heart, *Memory Minder* is the tool you need to help you make your floppy disk drives work perfectly. If you don't like to tangle with things mechanical, *Memory Minder* is the second, wiser opinion that will confirm that your disk problems aren't all in your head or your software.

Performance Evaluation Programs

Core Disk Performance Test Program

In the PC industry, the most widely discussed measure of hard disk performance is average access time, and the company more responsible than any other for creating awareness of this measurement has been Core International. The company's *DISKP* program is probably the most-used benchmark for measuring access time.

DISKP has its idiosyncrasies, however. In particular, at completion, it produces comments on disk quality that are less than tactful as well as quite self-serving on Core's part. *Coretest*, the nickname for the *Core Disk Performance Test Program*, eliminates the editorializing and adds another valuable benchmark to its small repertoire of disk examinations—a test of data transfer rate.

Designed solely to measure hard disk performance, *Coretest* can help you evaluate the desirability of different drive units, including direct comparisons of two units connected to the same computer.

Using the program is elementary: type in its name at the DOS prompt. *Coretest* immediately searches out disk hardware (it does not work with disks implemented with software drivers) and runs two tests. First it reads 1 megabyte of data to determine transfer rate, then it shuttles the head across the disk to find average access time. If two hard disks are connected to the system, it evaluates both of them in turn.

The results, along with major disk characteristics like head and cylinder counts,



EDITOR'S CHOICE

FACT FILE

Memory Minder
J&M Systems
15100-A Central SE
Albuquerque, NM
87123
(505) 292-4182
List Price: \$110
Requires: 128K RAM,
one floppy disk drive.

In Short: A floppy disk drive evaluation system that examines the mechanical operation of a drive and reports its results with text-mode graphics, suitable for making drive alignments. Not copy protected.

CIRCLE 627 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

are displayed in tabular form. In addition, *Coretest* uses text-mode graphics to produce a bar chart of each of the two performance measures of both disk drives so that competing hard disks can be visually compared.

**FACT FILE**

**CORE**
INTERNATIONAL

Core Disk Performance Test Program
Core International
7171 N. Federal Hwy
Boca Raton, FL 33431
(305) 997-6055
List Price: Free
Requires: 138K RAM,
hard disk drive, DOS 2.0 or later.
In Short: A hard disk performance evaluation test that quickly determines the average access times and data transfer rates of one or two drives, and compares two drives. If that's all you want to know, this product is for you. Not copy protected.
CIRCLE 807 ON READER SERVICE CARD

Direct comparisons of drives using *Coretest* can only be made using the identical computer as the test bed for each one, however. In testing, system processing speed had a distinct effect on data transfer rate measures. That's as it should be because faster systems can move data quicker. Note, too, that because of the slow speed of PC processors, data transfer rates don't even approach the 5-megabit-per-second rating of common disk controllers.

Strangely, the average access times (which should be independent of both computer and test program) that *Coretest* derives can vary substantially from those achieved with the elderly *DISKPC*. *Coretest*, however, is quite repeatable. As long as it is used consistently, the results *Coretest* delivers should offer a valid comparison of competing hard disk products.

PC Magazine Laboratory Benchmark Series

PC Magazine's own *Laboratory Benchmark Series* (now in its fourth release) gives you similar abilities to those of *Power Meter* in evaluating various aspects of

system performance but reports using its own quantification scale.

Although written primarily as a tool to be used by laboratory technicians, the PC Labs benchmark tests require neither training or deep understanding of PCs to operate. The easy-to-use menu-driven format lets you select among several test categories: microprocessor and memory evaluation, disk testing, display testing, and printer testing.

The tests are not diagnostic (except in the most general way) but measures of system performance. The disk tests, for instance, measure the average access time of the drive undergoing evaluation by several methods but do not apprise you of media defects.

Unlike *Power Meter*, the PC Labs benchmark tests do not keep a disk-based database of the various systems that they evaluate, although some of the individual benchmarks allow automatic on-paper logging.

Because these programs are identical to those used by the PC Labs staff in evaluating equipment for *PC Magazine*, the results you get will be directly comparable to those that we publish—the largest library of personal computer test results and evaluations available anywhere. Increasingly, these benchmarks are used by manufacturers in advertising, evaluating, and even developing their products.

They are also cheap, available free from many bulletin boards or directly

through the PC Magazine Interactive Reader Service without charge (except for the telephone call).

Power Meter

Power Meter, from The Database Group, is a measurement tool whose primary purpose is to evaluate competing products. It can also be used as a form of diagnostic.

Power Meter measures both overall system processing ability and the performance of its major components: the microprocessor and memory, the mass storage system, and the display system. Each of these areas is further subdivided into a number of tests.

To give an overview of total system performance, *Power Meter* simulates the operation of spreadsheets, word processors, databases, CAD systems, and a program assembler/compiler, as well as offering an aggregate test that's supposedly representative of general-purpose PC use.

The microprocessor and memory tests include an evaluation of system performance on a number of machine language instructions, execution of the NOP (No Operation) instruction alone, a run-through of the Sieve of Eratosthenes, Whetstone and Dhrystone (mips, or million floating-point instructions per second) tests, and a block move test of expanded memory.

Disk drive tests include an aggregate test, a sequential track seek test, a random access test, and a measurement of data transfer rate.

The video tests evaluate the speed of display adapters operating in text mode and on two types of graphics tasks, line drawing and area filling. In addition, *Power Meter* provides a series of screens for subjectively evaluating monitors.

Built into the program is a database system for managing test results. The results of any or all tests for any system can be stored on disk and then compared with those of others that have been previously evaluated.

To aid in such comparisons, *Power Meter* presents many of its ratings in Power Meter Units, which are relative measures between the system undergoing evaluation and any chosen system in the database.

Power Meter is essentially menu driven

**FACT FILE**

**PC Magazine Laboratory Benchmark Series**
PC Labs
One Park Avenue
New York, NY 10016
(212) 503-5570
List Price: Free
Requires: 512K RAM,
one floppy disk drive, DOS 2.1 or later.
In Short: A collection of performance evaluation programs—the same ones used by PC Labs—that report microprocessor, hard disk, and printer speed and display quality using a variety of industry-standard tests. Not copy protected.
CIRCLE 808 ON READER SERVICE CARD

■ DISK DRIVE UTILITIES

and provides a reasonable amount of context-sensitive on-line help. In fact, the instruction manual is almost unnecessary except for reference and explanation of the significance of the various tests.

The program has its weaknesses. For instance, tests must be run individually, even though the overall system evaluations seem to be different weightings of the results of some very similar benchmarks. The aggregate test could easily be designed to establish all aspects of the performance of the system in every application area in one swoop.

As a diagnostic, the best application of *Power Meter* is to run the program when initially setting up your system, then periodically retesting to determine whether any degradation has occurred. Unfortunately, the most probable disk problem, gradual media failure, is unlikely to show up with this test regimen.

As an evaluation aid, you can tote the *Power Meter* disk to your dealer's showroom and give the various systems you're considering a complete run-through—if your dealer will put up with such shenanigans.

Power Meter does accomplish its design intention. Its test results correspond to the subjective feel of a system and to the general level of performance that can be measured by other benchmarks. Like other benchmarks, it may tell you more than you want (or need) to know, particularly if

PC EDITOR'S CHOICE

- Disk Manager
- Memory Minder
- PC Magazine Laboratory Benchmark Series
- Power Meter
- SpeedStor

For simplifying hard drive installation, Storage Dimensions' SpeedStor and Ontrack Computer Systems' Disk Manager run neck-and-neck. Choose the one with the lowest street price.

If you need to tangle with floppy disk problems and alignments, we'd pick J&M Systems' Memory Minder because it graphically gives you the most help in setting things right. Although Verbatim Corp.'s good! bad approach may be quicker, odds are you're going to pull out the product only after something has already gone bad, and whatever secrets it reveals will prove redundant.

For performance testing, we'd yank our favorite software off the shelf—the stuff we're going to be stuck running on the hardware we're investigating—and see how the combination works. That's the only real means of gauging your own satisfaction with a particular product.

If you want a less subjective arbiter, Power Meter will help you make your own comparisons, and the PC Magazine Laboratory Benchmark Series will aid in comparing your prospective choices with our huge database of test results. Although we're hardly impartial, given the price difference, we'd rank the latter on top.

your PC is a working tool and not the object of an obsession.

Winn L. Rosch is a contributing editor of PC Magazine.

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FACT FILE



Power Meter
The Database Group Inc.
3031 Tisch Way, #2
Plaza West
San Jose, CA 95128
(408) 241-2981
List Price: \$89.95
Requires: 256K RAM,
hard disk drive, DOS 2.0 or later.

In Short: A personal computer performance evaluation system that allows the comparison of the effective operating speeds and quality of computers, hard disks, displays, and printers on a variety of chores. Includes a modest database manager for tracking your results. Not copy protected.

CIRCLE 622 ON READER SERVICE CARD

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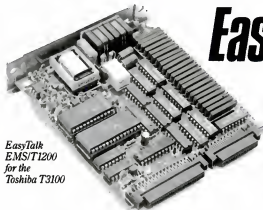
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■ PC LAB NOTES: EXTENDED ASCII ■ JEFF PROSISE

MORE CHARACTERS FROM YOUR KEYBOARD

Most applications programs don't let you use the graphics and language characters in the IBM character set. Here's a utility that will access them.

The IBM version of the extended ASCII character set contains 254 displayable elements. Of these, the 83 keys on the standard PC keyboard directly produce only 94—slightly more than a third. While the AT keyboard and the new “enhanced” IBM keyboard support additional functions, they don’t directly generate any more characters.

The additional characters cover everything from graphic elements to Greek letters to mathematics symbols. Some commercial packages incorporate at least a subset of them. *WordPerfect*, for one, lets you dress up text by enclosing it in a box. Others, such as *XyWrite*, let you enter any ASCII character by holding down the Alt and Shift keys while typing a three-number code on the numeric keypad. That’s fine if you’ve memorized all the ASCII codes and don’t mind the finger gymnastics needed to generate a single character. But there ought to be an easier way.

There is, and in this article I’ll present a short memory-resident utility that supplements the normal keyboard BIOS. After loading KBX.COM you’ll be able to make most (though not all) word processors and text editors handle documents requiring scientific, foreign language, and line-drawing characters as easily as they now accommodate regular ASCII texts. Before getting to KBX, however, it’s well to examine the keyboard: its components, what happens when a key is triggered, and its BIOS interface.

The standard IBM keyboard contains a dedicated Intel 8048 microprocessor that monitors all key action and reports any clo-

sure or disclosure to the CPU via a hardware interrupt. When a key is pressed, the keyboard generates an interrupt 9 and puts what the BIOS terms a *make* code in the keyboard data port. The make code is nothing more than the scan code of the key just struck. Releasing a key generates a *break* code. The break code is simply the

scan code with its high bit set: in other words, it is the value of the make code plus 128. When a routine vectored to by interrupt 9 takes control, it can determine which key was activated and whether it was depressed or released by reading the make or break code from port 60h.

An additional task delegated to the 8048 is issuing repeated make codes when a key is held down. After key contact has been maintained for about a half-second, interrupts are generated several times per second just as if the key were being alternately pressed and released. This results in the keyboard’s “typematic” action. The BIOS masks out the repetition both of shift keys (e.g., Ctrl and Alt) and of those (like Ins) that toggle a state.

As an alternative to using interrupts and a secondary microprocessor, many microcomputer systems detect keystrokes by the “polling” method. In that kind of design the CPU automatically checks the keyboard port for a keystroke periodically. And since the keyboard must be polled many times per second to make sure nothing is missed, a significant portion of the CPU’s time is diverted from other tasks. Thanks to the architecture of the PC and its smart keyboard, though, polling is neither necessary nor desirable. Instead, the 8048 sits quietly in the background and grabs the attention of the 8088 only when keyboard action is detected.

When an interrupt 9 is generated, execution goes to the keyboard interrupt handling routines in the system BIOS. BIOS stands for Basic Input/Output System; its routines are stored in ROM and handle all

PRODUCTIVITY INDEX

PC LAB NOTES

KBX keys extended ASCII characters into almost any text file.

UTILITIES

RN’s directory tree manipulates directories with just a keystroke.

ENVIRONMENTS

Help for readers as OS/2 and Windows nudge DOS off the PC scene.

SPREADSHEET CLINIC

Trapping 1-2-3’s error trapping; @ calculation disorders.

USER-TO-USER

Nesting IF statements; extended ASCII in DEBUG; NumLock beeper.

POWER USER

An expanded column wholly devoted to *WordPerfect* tips and macros.

LANGUAGES

Managing or disabling Turbo Pascal error trapping; a full-color EGA.

PC TUTOR

End-of-file markers; keeping a tab on tab width; toggling into turbo.

CONNECTIVITY CLINIC

Connecting far-flung PCs; LAN reform of minis; faster hard disks.

■ PC LAB NOTES

THE KEYBOARD BUFFER

After a scan code is transformed by the keyboard BIOS into an equivalent ASCII code, it must somehow be made available to the running application program. The mechanism used to do this is the keyboard buffer.

The buffer makes sure that keystrokes aren't lost if the typist outpaces the rate at which characters are processed. Each one is stored away until the computer is ready for it. Even keystrokes that are processed immediately reside in the buffer for a short time. It's the only route a character can take from the keyboard to a running program.

The keyboard buffer is a circular queue that can temporarily hold up to 16 two-byte entries. Two bytes in the buffer represent one character. The BIOS maintains four parameters in its own data area that pertain to the buffer: the address of the buffer head, the address of the buffer tail, and the starting and ending addresses of the buffer itself. The tail is where the next character will be written to; the head is where the next character will be read from. The BIOS routines that handle a call to interrupt 9 place characters into the buffer. Entries are read when a program invokes interrupt 16h with the AH register set to zero.

The buffer is empty when the address of the head is the same as that of its tail. It's full when the tail lags behind the head by only two bytes. If you type a character

with the buffer full, a short beep warns you that the PC can't accept another character until one is read to make room. When interrupt 16h is requested to perform a read, it effectively deletes the entry after reading it by adding 2 to the head address. When a character is inserted, the tail address is incremented by 2 so that the next entry won't overwrite the last. The tail and head wrap around to the start when the most recent advance causes one of them to overshoot the end of the buffer. Thus, the tail forever chases the head but is never allowed to overtake it.

The BIOS uses the starting and ending buffer addresses when it wraps the head or tail around to the beginning. But rather than being hardwired into the code, these values are maintained in a memory location where they can be altered by the user. Such a design allows the buffer to be modified. By changing the starting and ending addresses, a program can relocate the buffer to any free area of memory (including inside its own allocated area) and can make it as short or as long as it chooses. There are many utilities available that extend the buffer's 16-character capacity to something greater. That's useful if you want to type ahead when the computer is involved in another task (like compiling a program to disk) and, for the moment, can't take time out to process keystrokes.

Programs can directly manipulate the

keyboard buffer, but only with caution. Interrupts must be disabled so that one routine won't attempt to insert an entry at the same time that another routine is involved in modifying the head and tail addresses. The INSERT_CHAR routine in KBX shows how an insertion can be made. Although it may appear that interrupts are enabled when INSERT_CHAR receives control since an STI instruction has been executed, in reality they are not. Hardware interrupts like the one generated by the keyboard are funneled through a chip called the 8259 Programmable Interrupt Controller (PIC for short). The 8259 acts as a sort of secretary for the main microprocessor, screening its calls and holding those that come while another interrupt is being processed. A pending interrupt 9 is delayed until the current interrupt 9 routine formally ends the interrupt hold state by OUTing the value 20h to port 20h.

For additional discussion of the keyboard buffer and how it works, see Steve Holzner's Programming/Utilities column in Volume 5 Number 18. The VISI-TYPE utility presented there not only expands the buffer to 80 characters but displays its contents in real time. It's a healthy aid to gaining a better understanding of an entity that is normally neither seen nor heard, but whose presence is vital to the operation of the computer.—Jeff Prossie

of the hardware chores, from those required to maintain system integrity to those provided as part of the programming interface. The keyboard routines in the BIOS are responsible for reading and interpreting the scan code and taking appropriate action based upon its value.

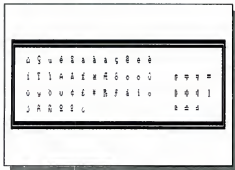
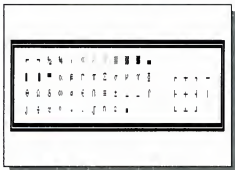
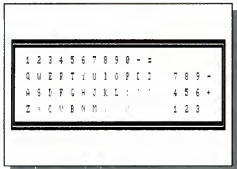
A KEY TO THE KEYS What happens when a make or break code is received depends upon the kind of key involved. The IBM keyboard divides its keys into three classes: those that produce a code to be delivered to the keyboard buffer (the alphanumeric keys, function keys, and a few

others such as PgUp and PgDn); the four shift keys (Left and Right Shift, Ctrl, and Alt); and the four toggle keys (NumLock, ScrollLock, CapsLock, and Ins). When a character key is pressed, the make code is translated into an ASCII code and deposited in the keyboard buffer. (The sidebar "The Keyboard Buffer" explains how the buffer operates.) A character key's break code is simply ignored. If one of the shift keys was pressed, the corresponding bit in the shift status byte (which is maintained in the BIOS data area) is set, indicating that the key is currently being held down. Releasing a shift key clears the bit. If one of

the toggle keys was pressed, a byte that keeps track of the current NumLock, ScrollLock, CapsLock, and Insert states is altered to reflect it. A break code generated by the release of a toggle key, like that of a character key, is discarded.

Most keys can take on more than one meaning, depending upon such factors as whether one or more of the shift keys is pressed or whether CapsLock or NumLock is active. The Home key, for example, must generate a 7 if either one of the two Shift keys is used with it or if NumLock is in effect. The NumLock and ScrollLock keys are used in conjunction

VIEWING THE KEYBOARD



Top: Pressing Alt-Shift brings up a display of the keys to which extended-ASCII assignments have been made. Center: Pressing NumLock shows the corresponding characters that can be inserted with NumLock-key combinations. Bottom: Similarly, pressing ScrollLock shows the ScrollLock-key characters.

with Ctrl to signal a pause or break action. Ctrl-Alt-Del must be trapped and made to result in a system reset. Shift-PrtSc generates an interrupt 5 to print the contents of the screen. Unlike a typewriter keyboard, where at most a key can be shifted or unshifted, the computer keyboard presents a whole host of possible keystroke meanings, all of which must be checked.

The keyboard definition depends wholly upon how the BIOS is written. The BIOS routines are listed in the *Technical Reference* manual that IBM publishes for each version of the PC. By substituting his own code for the BIOS routines, or simply by attaching a short front-end to them, a programmer can mold the keyboard to his own liking. As you've probably anticipated, that's exactly what KBX is going to do. Thanks to the flexibility the IBM keyboard-BIOS relationship imparts, the actual coding of an enhanced keyboard utility is a lot less complex than you might imagine. In fact, a couple of hundred bytes of code could do the job quite nicely in a barebones approach. Add another couple hundred for the extras, and the result is a greatly improved keyboard obtained at the cost of only a fraction of usable RAM. The problem at this point is not how, but what to code.

DESIGNING KBX The first problem is deciding how best to provide access to the extended character set without compromising existing keyboard functions. One logical choice would be simply to extend the manner in which normal keys are already made to double their assignments: with the DOS shift keys. Since the Left Shift and Right Shift keys themselves are already used with all the character keys, they're obviously out of the question. But it would seem perfectly natural to take combinations formed using the Ctrl and Alt keys in conjunction with a character key, i.e., Ctrl-A and Alt-A, and cause each one to produce a unique, extended ASCII character.

Unfortunately, of course, it's such a natural idea that others have already taken advantage of it. Many existing software products already use the Ctrl and Alt combinations for their own purposes. *WordStar*, for instance, is passed instructions with Ctrl-key combinations. 1-2-3 relies

INCOMPATIBILITIES

If you wonder why some word processors won't allow even a utility such as KBX to enter the high-order characters, your curiosity is perfectly natural. The answer is buried deep within the heart of each offending application.

Some editors, like *WordStar*, assign a special meaning to the high bit of the 8-bit character code. If you TYPE a text file created in *WordStar*'s document mode, you'll see that the last letter in every word has been transformed into a graphics character. The characters haven't been destroyed; *WordStar* has simply added 128 to the ASCII value of each one by setting its high bit. The bit can be set or reset with a single assembly language instruction, making it a convenient way to flag the end of a word, sentence, or paragraph. *WordStar* can't allow you to enter ASCII codes greater than 127 without

confusing them with its own formatting codes.

Some applications exclude special characters without a specific reason. The *SideKick* editor, for example, stores text in a pure ASCII format, but won't let codes greater than 127 be entered. *WordStar* working in nondocument mode does likewise.

The following lines of assembly code (or something similar) are often used to read an input string from the keyboard:

```
GETKEY:  MOV AH,0
          INT 16H
          CMP AL,13
          JE DONE
          CMP AL,32
          JB GETKEY
          CMP AL,126
          JA GETKEY
PRINT_CHAR:  .
            .
            .
```

Interrupt 16h is called to wait for a key-press and retrieve a buffered keycode, and the loop terminates when the ENTER key (ASCII code 13) is pressed. High-order characters are excluded by the second CMP instruction. Similarly, substituting AND AL,7Fh for the CMP AL,126/JA GETKEY test strips the high bit of the character.

A constantly increasing number of new applications are being written in languages such as C and Pascal, and fortunately for users, the standard keyboard input functions of these recently developed compilers don't restrict characters to 7 bits. My own informal tests showed that Turbo Pascal's READLN, Turbo C's SCANF, and QuickBASIC's INPUT routines all allow the entry of members of the extended ASCII set.

—Jeff Prossie

is retrieved from a lookup table and inserted into the keyboard buffer.

A minor consideration is which upper-ASCII character to assign to each key. There are obviously many different combinations available, one not necessarily better than another. It makes sense, however, to assign the box-drawing characters to the numeric keypad, where the layout closely parallels the functions of the characters themselves. Make the Home key generate the upper left corner of a box, the PgUp key the upper right corner, and so on, and the layout will make intuitive sense.

One problem with stealing use of the ScrollLock key is that the Break function is assigned to Ctrl-ScrollLock. Further, the pause function is invoked with Ctrl-NumLock. A proper keyboard utility must pass any press of Ctrl-ScrollLock or Ctrl-NumLock through to their normal BIOS routines. A conservative approach, indeed, will pass through any combination of the Ctrl or Alt keys together with ScrollLock or NumLock just as if no interception had occurred.

There's also the problem of letting the user know which characters are assigned to which key combinations. The characters

normally produced when keys are struck are embossed right on top of the keys themselves. It's easy to remember that Shift-8 produces an asterisk because the asterisk is printed on the keytop. But how can a program make it easy for the user to see that NumLock-F produces an infinity symbol? It can't alter the looks of the keyboard. And it certainly can't rely on the operator memorizing the layout of the entire extended character set as an experienced typist does the standard one.

It's here that the PC can take a lesson from the Apple Macintosh. That computer includes a sort of auxiliary shift key called an Option key through which extra characters are accessed. The user can open an on-screen window that shows a replica of the keyboard. When the Option key is depressed, the keys change to reflect the character set assigned to the Option key. Releasing it restores the keyboard image to the default character set. It's a great mechanism, and one that is unparalleled in elegance and ease of use.

The same thing can be done with the IBM PC. The new keyboard utility should provide a window that depicts the keyboard and its normal character layout, but

which changes, when NumLock or ScrollLock is pressed, to reveal the new characters assigned to each key position. With that, the foundation for a complete and workable system has been laid. Almost any member of the extended ASCII character set can be typed from the keyboard simply by pressing NumLock or ScrollLock in conjunction with a normal character key. All that remains is to implement the system.

KBX.ASM, the source code for KBX, and KBX.BAS, a program that will create KBX.COM, are listed elsewhere in this article. To save the keyboarding chore, both files, and even a ready-to-run KBX.COM file, are available for downloading by modem from the PC Magazine Interactive Reader Service, as explained in the sidebar "KBX by Modem."

USING KBX KBX.COM (for eXtended KeyBoard) embodies all the considerations discussed above. It's an enhanced keyboard utility that stretches the power of the keyboard to provide access to most members of the extended character set. New characters are produced by typing a character with NumLock or ScrollLock

■ PC LAB NOTES

```

100 REM --- BASIC PROGRAM TO CREATE KBX.COM
110 OPEN "KBX.COM" AS #1 LEN = 1
120 FIELD #1 AS AB
130 CHECKSUM = 0
140 FOR I = 1 TO 101
150   LINESUM = 0
160   FOR J = 1 TO 8
170     READ BYTE
180     CHECKSUM = CHECKSUM + BYTE
190   LINESUM = LINESUM + 1
200   IF (BYTE < 250) THEN LAST AB = CHR$(BYTE)
210   PUT #1
220 NEXT J
230 READ LINESUMOK
240 IF LINESUMOK < LINESUM THEN PRINT "Error in Line" (200 + 10 * I)
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 111381 THEN PRINT "Successful Completion" : END
280 PRINT "COM file is not valid" : END
290 DATA 233, 73, 4, 87, 111, 112, 121, 114, 830
300 DATA 185, 165, 184, 119, 32, 48, 67, 50, 822
310 DATA 57, 32, 99, 105, 102, 102, 45, 580
320 DATA 87, 118, 106, 118, 32, 86, 117, 98, 702
330 DATA 108, 105, 115, 104, 105, 118, 102, 32, 782
340 DATA 87, 111, 48, 25, 44, 40, 45, 41, 428
350 DATA 42, 48, 38, 78, 0, 0, 0, 0, 104
360 DATA 2, 0, 104, 67, 27, 7, 0, 0, 273
370 DATA 0, 0, 0, 0, 0, 0, 73, 80, 139
380 DATA 3, 12, 0, 0, 0, 0, 10, 93
390 DATA 0, 2, 0, 10, 7, 10, 0, 2, 38
400 DATA 0, 15, 0, 18, 0, 0, 50, 105, 50
410 DATA 4, 0, 0, 0, 0, 50, 7, 4, 70
420 DATA 0, 0, 0, 0, 0, 0, 3, 0, 87
430 DATA 48, 58, 01, 52, 83, 84, 05, 56, 438
440 DATA 27, 46, 45, 81, 0, 0, 81, 67, 379
450 DATA 88, 82, 84, 88, 85, 73, 76, 86, 843
460 DATA 82, 83, 82, 80, 85, 85, 79, 470
470 DATA 71, 72, 74, 75, 78, 09, 39, 90, 262
480 DATA 0, 0, 88, 88, 87, 85, 85, 78, 475
490 DATA 77, 44, 45, 47, 0, 0, 0, 214
500 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
510 DATA 0, 0, 0, 0, 0, 0, 85, 88, 87, 108
520 DATA 45, 82, 83, 84, 45, 49, 108, 82, 307
530 DATA 0, 0, 0, 127, 128, 129, 130, 131, 445
540 DATA 132, 133, 134, 135, 137, 138, 139, 140, 946
550 DATA 0, 139, 149, 141, 142, 143, 144, 144, 946
560 DATA 149, 147, 148, 149, 150, 0, 0, 181, 891
570 DATA 143, 143, 143, 143, 143, 143, 143, 143, 143
580 DATA 108, 101, 102, 0, 0, 103, 104, 105, 978
590 DATA 108, 107, 108, 0, 0, 0, 0, 0, 591
600 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
610 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
620 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0
630 DATA 201, 203, 187, 208, 206, 204, 185, 187, 1577
640 DATA 171, 172, 173, 174, 175, 176, 177, 178, 1368
650 DATA 179, 180, 181, 182, 183, 184, 185, 186, 1368
660 DATA 225, 226, 227, 228, 229, 230, 231, 232, 1638
670 DATA 0, 0, 233, 234, 235, 236, 237, 238, 1415
680 DATA 240, 241, 242, 243, 244, 0, 0, 1448
690 DATA 240, 240, 247, 248, 249, 250, 251, 252, 1080
700 DATA 233, 254, 0, 0, 0, 0, 0, 0, 697
710 DATA 0, 0, 0, 0, 0, 0, 179, 179, 88
720 DATA 0, 0, 0, 218, 104, 191, 168, 109, 954
730 DATA 107, 108, 170, 102, 103, 217, 0, 0, 1150
740 DATA 201, 86, 228, 98, 86, 118, 33, 833
750 DATA 80, 197, 138, 86, 88, 79, 118, 77, 798
760 DATA 84, 108, 118, 113, 89, 0, 110, 124, 84
770 DATA 80, 88, 80, 80, 1, 3, 489
780 DATA 233, 142, 0, 88, 48, 280, 48, 75, 883
790 DATA 0, 0, 232, 189, 0, 107, 883
800 DATA 0, 0, 232, 189, 0, 86, 158, 3, 117, 883
810 DATA 0, 46, 128, 14, 93, 1, 2, 230, 448
820 DATA 77, 144, 18, 184, 44, 218, 218, 385
830 DATA 128, 54, 23, 0, 32, 31, 230, 82, 888
840 DATA 144, 232, 137, 0, 88, 138, 58, 83, 798
850 DATA 1, 253, 238, 144, 32, 138, 4, 385
860 DATA 108, 12, 117, 191, 88, 232, 117, 0, 817
870 DATA 86, 168, 3, 117, 0, 48, 128, 14, 871
880 DATA 83, 0, 1, 1, 1, 1, 1, 1, 870
890 DATA 84, 0, 142, 218, 128, 84, 23, 0, 827
900 DATA 8, 31, 23, 18, 144, 0, 1, 1, 870
910 DATA 42, 128, 38, 83, 1, 254, 178, 32, 728
920 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148
930 DATA 0, 118, 138, 232, 83, 0, 178, 32, 783
940 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148
950 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148
960 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148
970 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148
980 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148
990 DATA 238, 32, 88, 287, 232, 83, 0, 108, 148

```

KBX.BAS: A BASIC program that will automatically create KBX.COM.

depressed. A pop-up window lets you review the new key assignments. Elements used to create boxes are dedicated to the numeric keypad for ease of use. Ctrl-Break and Ctrl-NumLock operate completely unimpeded, and the normal NumLock and ScrollLock functions are activated if you hold down either of the Shift keys while pressing NumLock or ScrollLock. Other-

wise, the keyboard works normally.

Load KBX by typing its name at the DOS command prompt or by including it in an AUTOEXEC file. (Before loading it at the DOS prompt, make sure that NumLock and ScrollLock are toggled off, i.e., are in their bootup state.) To take a look at all of the newly available characters, press Alt-Spacebar (the Alt key and the Space-

bar together) to open the layout window. You'll see a table of characters that represent the character keys on the keyboard and the numeric keypad. Then press and hold the NumLock key. The character table will change, showing the new symbols that are generated by each key when NumLock is held down. Releasing NumLock restores the normal set. Pressing Scroll-

KBX by Modem

The programs published in *PC Magazine* can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards) as long as no charge is involved. However, making copies for any commercial purpose is strictly prohibited.

The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1200 (or 300) bps, 8 data bits, 1 stop bit, no parity. Files with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; files with .ASM or .BAS extensions can be downloaded using either regular ASCII or Xmodem.

If you use the Xmodem protocol, you can download KBX.COM directly, saving typing or downloading either the .BAS or the .ASM version. KBX.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create KBX.COM when run once in BASIC. KBX.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```

MASM KBX;
LINK KBX;
EXE2BIN KBX KBX.COM

```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.



Jeff Prossie

KBX Command

1987/No. 16 (Lab Notes)

Purpose: Allows entering extended-ASCII line-drawing, foreign language, math, and science symbols from within word processing programs and editors that would not otherwise support them.

Format: [*d* :][*path*]KBX

Remarks: KBX is a memory-resident utility and is normally loaded as one of the command lines in your AUTOEXEC. BAT file. At any point after loading, pressing Alt-Space pops up a window that displays the normal PC keyboard layout. While this window is on-screen, pressing NumLock shows the key locations for one of the two extended-ASCII sets; pressing ScrollLock similarly displays the other extended-ASCII set. Esc closes the display and returns to any active applications program.

To enter the extended-ASCII characters, hold down the NumLock (or ScrollLock) key and press the key at the appropriate position. Note that the single-line (NumLock) and double-line (ScrollLock) box-drawing characters are arranged around the outside of the numeric keypad.

Using the NumLock and ScrollLock keys as additional "shift" keys avoids conflicts with applications programs that normally use Alt-key and Ctrl-key combinations. The normal Ctrl-NumLock (pause) and Ctrl-ScrollLock (break) combinations continue to work without change. When KBX is loaded, however, Shift-NumLock and Shift-ScrollLock are used to toggle the NumLock and ScrollLock states.

KBX is not compatible with word processors that normally make use of the 8th ("high") bit for their own purposes (e.g., *WordStar*) or that utilize their own keyboard handlers (e.g., *XyWrite*). Only experimentation will show whether the program will work with a given editor.

Note:

Since different printers vary in the characters they output when presented with extended-ASCII codes, you must determine either from your manual or by experiment whether your printer's character set is compatible with that PC.

■ PC LAB NOTES

Lock produces yet another set of characters, all accessed by pressing the appropriate key in unison with ScrollLock. Pressing Esc closes the window and restores the screen beneath it.

Once you're back to the DOS command prompt, if you hold down the NumLock key and strike the G key, a small Greek phi (it resembles a zero with a vertical slash) will appear at the cursor position. Pressing ScrollLock-G will display the cent symbol. Pressing the G key by itself will still produce a lowercase character (unless CapsLock is on), and Shift-G will still generate an uppercase G. KBX lets you have the best of both worlds. Remember that anytime you want to see which character is assigned to each key, Alt-Spacebar opens the layout window. It will come up at any time except when the PC is in graphics mode. Even then, the extended keys will function properly.

The symbols assigned to the numeric keypad can be used to construct boxes, tables, and lines around text or to add simple graphics to a document. The NumLock set is composed of the single-line symbols; the ScrollLock set employs the double-lined ones. Shaded characters, great for drawing borders or otherwise highlighting areas of a document, are generated with NumLock-8, 9, 0, and -. Calculus buffs who have in the past added integral signs to their typed papers by hand will find they can combine two characters vertically, NumLock-` (the grave accent) and NumLock-Z, to obtain one.

There are two caveats about using KBX. First, some word processors won't permit you to enter an extended code. The use of more than 128 different characters requires that each one be represented by 8 bits, one more than the standard 7-bit ASCII definition. Some programs, like *WordStar*, use the eighth bit for their own purposes, as explained in the sidebar "Incompatibilities." And, much to my editor's chagrin, KBX will not work with the special keyboard handler intrinsic to *XyWrite*. The only way to tell if your favorite word processor is compatible with KBX is to try it. Most plain text editors, at least, won't have any problems.

Printers can introduce a different kind of incompatibility. IBM printers employ the same full character set as the IBM com-

puters. Older Epsoms have the same first 128 codes but implement their own extended set. Many new printers contain a DIP switch by which an IBM character set or a proprietary set can be selected. If the upper 128 characters on your printer don't match IBM's, a printed document that contains KBX characters won't appear as it did on the screen. The manufacturer's own symbols will replace the new ones. Check your printer manual before assuming that the KBX utility will solve your document woes—or, since it's so easy to do, just try it.

UNDERSTANDING KBX KBX is nothing more than a simple keyboard driver designed to reside at the front end of the BIOS routines that normally handle interaction between the keyboard and CPU. The keyboard interrupt vector is chained to the KBX code. When the keyboard generates an interrupt signaling that it needs attention, the resident code grabs it before the BIOS does and checks to see if any one of a number of events occurred.

If NumLock was pressed or released, bit 1 of the byte labeled AUX_SHIFT in the source code is set or cleared, respectively. The same is true of ScrollLock and bit 0. Since this byte maintains a record of the status of the two newly defined shift keys at all times, KBX can see if one or both is depressed by checking the value of AUX_SHIFT. This operation closely parallels the way the BIOS keeps track of the status of the Ctrl, Alt, and Shift keys.

The above is always true unless Ctrl, Alt, or Shift is depressed at the same time NumLock or ScrollLock is struck. If either Ctrl or Alt is active, control is passed on to the normal keyboard routines. That way special combinations like Ctrl-NumLock (pause) and Ctrl-ScrollLock (break) work unimpeded. If Shift-NumLock is entered, KBX toggles the bit in the BIOS data area at segment 40h that records the actual NumLock state. Shift-ScrollLock toggles the ScrollLock state. Both functions are crucial if basic keyboard operation is to be unaffected by KBX.

Another event checked for is the press of Alt-Spacebar, which signals the layout window to pop up. If this is detected, the KBX keyboard handler calls the KB_DISPLAY procedure to open the window and

respond to presses of NumLock, ScrollLock, and Esc. Significantly, the video routines required by KB_DISPLAY make up the majority of the code.

The final occurrence KBX watches for is a press of any key in conjunction with NumLock or ScrollLock. To generate an extended character, the utility uses the value of AUX_SHIFT to determine whether to extract the ASCII code from the NumLock table or the ScrollLock table. Both tables, as well as a third that defines the default unshifted code for each key, can be found in the source code. The scan code is then used as an index into the table and an ASCII value is retrieved. If the value is zero, KBX does nothing. A zero means that the key doesn't produce an extended character. But a nonzero value entices the keyboard driver to call the INSERT_CHAR routine to insert the ASCII code, along with its corresponding scan code, into the keyboard buffer. The character is placed in the buffer just as if the BIOS had added it. The running applications program that requested the keystroke never knows the difference. For more details concerning the keyboard buffer and how it works, see the accompanying sidebar "The Keyboard Buffer."

OPENING THE WINDOW The routine KBX calls to open the layout window is similar to many others that have appeared in *PC Magazine* utilities. In a nutshell, the character/attribute byte pairs that define the window are written one at a time to video memory. It happens so fast that the window appears to the eye to pop up almost instantly. The only precaution that has to be taken is to disable the video signal before the writing begins if a standard Color/Graphics Adapter is being used. If that requirement is ignored, the display is momentarily filled with ugly interference lines. The signal is enabled again as soon as video memory is modified.

Closing the window is as simple as restoring the saved contents of video memory. Each byte that is overwritten when the window is opened is tucked safely away before opening actually occurs. The same precautions that apply to the latter process on a CGA apply here as well, as they do any time CGA video memory is accessed by the microprocessor.

It's what happens between the opening and closing that's special. An application that wants to read a keystroke typically calls interrupt 16h, function 0, to do the work. KBX has to be a bit more sophisticated. The BIOS function call hangs the computer in an endless loop until a character appears ready to be read from the keyboard buffer. But that means keys like Ctrl, Alt, NumLock, ScrollLock, and others that don't generate a buffered keycode won't register. So KBX uses interrupt 16h, function 1, to initiate a loop that continues until Esc is pressed but responds to changes to AUX_SHIFT in the interim.

When function 1 returns and indicates that the keyboard buffer is empty, KBX immediately turns its attention to the auxiliary shift byte. If it hasn't changed in value since the last iteration of the loop, execution jumps back to start the looping process anew. But if it has, the routine `FILL_WINDOW` is called to handle the layout window. If NumLock or ScrollLock is depressed, the corresponding character set is displayed. If neither one of them is held down, the window defaults to the standard set.

Were it not for the video routines necessary to manipulate the window, the entire utility could all be packed into less than half a kilobyte. As it is, though, it doesn't require much of a sacrifice in RAM, and the pop-up window almost invariably adds to the program as a whole. A few other routines play a vital role in the scheme of things but won't be discussed in detail since they've been examined in depth in past columns. The initialization routine determines what type of video adapter is installed and adjusts assumed video values accordingly before calling interrupt 27h to make the program resident. It also redirects the keyboard interrupt vector. `READ_CURSOR` reads the current cursor position directly from the CRT controller for compatibility with ill-behaved programs. Both are well commented and worthy of closer inspection if you're new to the programming game.

IN CLOSING If KBX suits your taste but leaves out a few characters you would like to have included, the generated codes are easily altered with the aid of an assembler (if you download or type in the source

code) or `DEBUG` (if you have the .COM file only). A complete list of the assigned ASCII codes is found in the tables labeled `SCR_TABLE` and `NUM_TABLE` in the source. Each table contains 83 codes. The codes correspond in order to the scan codes generated by the keyboard. The Esc key, for example, generates a scan code of 1. The first byte in both tables is a zero, meaning that no extended character is placed in the buffer when NumLock-Esc or ScrollLock-Esc is pressed. To force NumLock-Esc to generate an infinity symbol, replace the first zero in `NUM_TABLE` with the value 236. A listing of all 256 ASCII codes can be found in almost any programming reference or in the back of your BASIC manual.

If you're intrigued by assembly language and want to learn how to write utilities like KBX.COM, purchase a copy of the *PC Technical Reference* manual. It, too, contains a diagram showing all 83 keys and their equivalent scan codes. More important, however, it contains a complete listing of your computer's BIOS, a rather long program in itself that provides the low-level interface to the outside world and manages unseen tasks like the power-on self test. It's an invaluable reference to hardware and BIOS programming. It's also a self-contained assembly language tutorial written by some of the best. Even if you own a compatible, almost everything inside the *Technical Reference* will apply directly to your machine. It's a must.

KBX is only one example of the kind of keyboard driver IBM's keyboard-BIOS relationship makes possible. IBM could have made things easier for itself—but less fun for us. The main microprocessor is given an additional load when it is required to translate incoming scan codes. It's not difficult to design a keyboard that does the translation for itself and reports ASCII codes directly to the system. That kind of keyboard, though, isn't easily altered. It lacks the flexibility required to implement utilities like KBX. The IBM keyboard as it stands now probably represents the best compromise between independence and flexibility that can reasonably be achieved.

Jeff Prosize is a contributing editor of PC Magazine.

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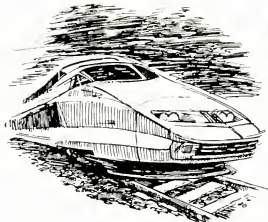
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■ UTILITIES ■ MICHAEL J. MEFFORD

A DIRECTORY WIDE FILE MANAGER



RN.COM creates a visual tree that lets you move about your subdirectory structure with ease, creating, deleting, renaming, and otherwise managing your subdirectories and files.

A nurse usually manages the doctor's office, leaving him free to concentrate on individual patients. That's the relation between RN.COM and the DR utility I presented in Volume 6 Number 14. DR facilitates listing, viewing, renaming, moving, deleting, and sorting individual files within a directory. RN is the complementary, diskwide utility that lets you move quickly among the branches of a directory tree, rename, create, and delete directories (including their contents), and change the attributes of all the files in a directory at once. To complete the picture, just as a nurse should always be able to reach the doctor immediately, so RN can call up DR with a single keystroke.

As the size of the figures for RN.BAS and RN.ASM shows, however, it takes a great many keystrokes if you choose to type in either of these alternate ways of creating your own copy of RN.COM. You're better advised to download the RN files you may want (.COM, .ASM, or .BAS) by modem from the PC Magazine Interactive Reader Service, as explained in the sidebar "Downloading RN."

RN has the same look, feel, and ease of operation as DR. Its syntax is

```
RN [d:][/I]
```

RN can either be entered as an immediate command or installed (using the /I option) on a hard drive, normally by being included as a line in your AUTOEXEC.BAT file. If no drive (d:) is specified, the current drive is assumed. When installed, RN maintains a resident database (approx-

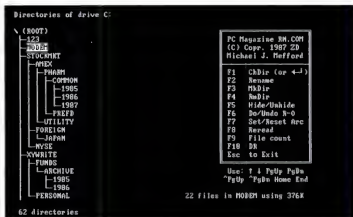
mately 14K in length) of directory information that speeds up its operations considerably. Although RN resembles a TSR with its resident database, it cannot be called up from another application with a "hot key." It can only be accessed from the DOS prompt. If installed, RN should be loaded before SideKick and other un-installable memory-resident programs. (RN cannot be uninstalled without rebooting.) While operating, RN requires 128K of RAM.

When RN is executed, an alphabetized directory tree, with the current directory highlighted, appears on the left side of the screen. On the right is a list of RN's menu options. The Up and Down Arrow keys

move the bar in single steps to highlight other directories, and Ctrl-PgUp/PgDn move it to the top and bottom of the current page. PgUp and PgDn make the local steps among directory pages; Home and End run express between the beginning and end of the directory line. Esc returns you to DOS.

FUNCTION KEY COMMANDS When you move the highlighted bar to another directory and press F1 (or Enter), you'll execute the DOS CHDIR command. And you'll never again make typos when entering the path to a fourth-level subdirectory.

If you're running under DOS 3.x, F2 lets you Rename the highlighted subdirectory. (Previous DOS versions do not sup-



The RN screen shows a directory tree with the current directory highlighted. The function key commands apply to the highlighted directory. The cursor keys move the highlight bar.

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■ UTILITIES

port directory renaming; this will be reflected by an N/A next to F2 in RN's menu.) If you change your mind in mid-stream, you can always cancel your request by hitting Esc. After entering the new directory name (without the backslash [\] delimiter) at the prompt, the directory tree will be updated automatically.

You can add subdirectories with RN's MkDir function. First, highlight the directory you wish to parent the offspring and press F3. RN will then display the number of characters in the path from the root to the highlighted directory, and it will ask you to enter the name of the new subdirectory. The reason for displaying the current path length is that DOS recognizes paths of only 63 characters. DOS will let you blindly create a path longer than the maximum, but it won't let you use it—you get a new file drawer but no keys to it. RN doesn't let you fall into this trap. If you're near the 63-character limit, don't forget to count the delimiting backslash (\). For example, if the path to the parent is 60 characters, you could safely add a subdirectory AB, but not ABC. Note: in making new subdirectories with RN, you should not actually type the delimiting backslash. RN does that for you and will ignore the keystroke. RN also ignores the space character (it's an illegal filename character), the colon (you can't enter drive names), and the "*" and "?" (wildcards).

The complement to MkDir is RmDir, F4. Highlight the directory you wish to purge, press F4, and RN will report the number of files and amount of disk space currently in the directory. If the directory is already empty, RN immediately removes it and updates the display tree. Unlike DOS, however, RN will allow you to remove a subdirectory together with all its files. RN gives you fair warning, of course, but if you tell it to go ahead and remove a file-laden directory, RN will delete the files and then the directory itself. At the warning prompt you can bail out by pressing Esc, or any key other than the confirming "Y", and your files and directory will remain intact. Note: RN cannot delete read-only files and so can't remove directories containing such protected files. RN alerts you to this situation by issuing a beep. F6 (discussed below) will take care of the problem.

F5 through F8 control the attributes of directories and files. F5, Hide/Unhide, lets you change the attribute of the highlighted directory, though it does not change the attributes of the individual files. A hidden directory attribute has the effect of protecting a whole group of files from prying eyes by omitting the directory from a DOS DIR command. (RN's directory tree still shows it, however, identified by an "H", and you can still access the files if you use the hidden directory name.)

■ Unlike DOS, RN will allow you to remove a subdirectory together with all its files. RN gives you fair warning.

F6, Do/Undo R-O, works the same way as F5 except that it is the read-only attribute of the individual files that is toggled. A file marked read-only cannot be deleted or written to. If a directory contains any such protected files, you'll have to use the F6 "U" (Undo) option before trying to use the F4 RmDir function.

F7, Set/Reset Archive, marks (or unmarks) all the files in a highlighted directory so they will be backed up if you execute the DOS BACKUP command. When the archive bit is Reset, DOS thinks the files have already been BACKUPed. To take advantage of this function, be sure to use the /M (modified) form of the BACKUP command.

Pressing F8 Rereads the disk and constructs a fresh directory tree. This may occasionally be needed if (as I recommend) you have elected to install RN's resident directory database. Using the /I option saves the few seconds needed to construct a directory map each time an RN function is executed. If you have done some directory maintenance at the DOS prompt without RN, however [Self medication?—Ed.], it may be necessary to force an update of the database. Note, however, that even without F8, RN will reread the

disk if you try to execute one of the directory functions on a nonexistent directory (i.e., one that has been removed with the DOS RD command).

RN reports the number of files and the amount of disk space they occupy when you activate any but the F5 file attribute functions. You can get this same report by itself with the F9 File Count function. The disk space calculation is not a sum of the individual file lengths but is rather a total of the actual physical space allocated to the files. As explained more fully in the section "Disk Layout" below, DOS saves files in sector units called clusters. While necessary to keep the number of entries in the File Allocation Table (FAT) manageable, the cluster system can result in devoting as much as 8K of disk space to a 1-byte file. If you're tight for space, however, note that RN's report, while based on cluster allocations rather than the bytes reported by DOS, does not include the somewhat mysterious dot and dot-dot directories. You may wish, therefore, to add two more files and cluster allocations to get a completely accurate count.

Finally, assuming you've already got a copy of DR (see Volume 6 Number 14), F10 puts the doctor permanently on call.

UNDERSTANDING RN The need to maintain a resident database for RN inspired an interesting terminate-and-stay-resident technique. The usual TSR pop-up utility daisy-chains itself in one or both of the most active hardware interrupts (the keyboard and the timer). This assures attention whenever a certain key combination (the hot key) is pressed or, alternatively, 18 times a second. RN's database, however, doesn't need that kind of attention. What it does need is insurance that the database will not be overwritten and that it can be found quickly later.

The first requirement is implemented in the same way other TSRs are protected: by terminating with INT 27h. This tells DOS that the first available memory starts at the end of the resident program. RN reads the necessary disk information during its installation process and then terminates, leaving behind a copy of its own code, including the compacted disk data. The next time you enter RN, all that is necessary is to expand the resident data into a directory

tree—if the data can be found. Between the time you installed RN and called upon its services, you may have used your spreadsheet or word processor or even loaded another TSR right behind RN. What RN needs is the ability to find its data quickly without randomly searching through memory for some kind of signature.

The solution I've employed is to take one of the seven user-defined interrupts to mark where RN is stored. On power-up, interrupts 60h through 67h are initialized with vectors of zero, indicating that they are reserved for applications and begging to be used. The Expanded Memory Manager (EMM) is one resident application (more precisely, a device driver) that takes interrupt 67h. Since device drivers are installed via the CONFIG.SYS file before any other application can be loaded, EMM can demand INT 67h without worrying that some other application will already have staked a claim on it. RN doesn't have quite that freedom, so it must look before homesteading any one of the user vectors.

Assuming, then, that the target is a fixed drive (floppy drives are removable media, and their directory trees aren't installed in the database), the first thing RN does is to look at all seven of the user interrupt vectors via INT 21h, function 35h. If the value of any of these vectors is other than zero, RN uses the segment and offset to see if it points to RN's resident database. RN uses the first 60 bytes of the install message at the beginning of the program as the identifying signature of its home. If found, RN immediately goes about the business of exploding the database into a displayable directory tree. RN doesn't even pause to see if the /I was included in the command line parameters. This prevents accidental multiple installations.

If RN doesn't find that it has been installed and that the /I was omitted, RN goes directly about reading the disk. The unprotected information gathered in this immediate mode will be trampled over by the next application when you press Esc and exit from RN back to DOS.

If an install request is found and at least one of the vectors is all zeros, RN inserts its address and then reads the disk. RN terminates and stays resident once all the directory information is neatly tucked away.

That way, the next time you enter RN, the vector-checking procedure discussed above will find the database.

RN waves a white flag with a message of "Too many resident programs" if none of the vectors are free and the /I was included. If this happens, and you don't want to give up any of your arsenal of TSRs, you can still use RN in the immediate mode, sans /I.

Since directories are just files with the special directory attribute (Table 1 displays the file attributes), the usual and easiest way to retrieve the directory information is through the DOS find first/next function calls. The call is made with 10h (the search attribute for directories) in CX. The problem with this technique is that DOS returns not only the directories but also all normal files as well. Compounding the problem is the fact that directory files, unlike all filenames in a single directory, are scattered throughout the disk, thus requiring multiple disk accesses. The slowdown in reading in the database is entirely unacceptable in a program that has been

unquestionably designed with speed as its number one priority.

The way to speed up RN's fact-finding mission is to bypass the DOS find first/next calls and instead to read sectors directly from the disk. This much more efficient strategy decreases RN's disk access time by 300 percent. While the exact time required will vary greatly with the size and speed of the disk, a reasonable average figure is 5 seconds to find all the subdirectories on a hard disk and produce the directory tree. The newer 20-millisecond disks can cut this time down to less than a second.

To read the disk directly sector by sector, RN has to know how the disk is organized, of course. The first sector of the disk (the boot sector) has all of the disk's credentials and so would seem to be the logical place to start, but unfortunately not all drives (Sperry/Unisys's, for example) have a boot sector. Fortunately, however, DOS has an undocumented function call that returns with the same vital stats for every disk. Issue INT 21h, function 32h with the number of the disk drive in DL and DOS returns with the disk layout. The details are shown in Table 2, and further discussion can be found in Charles Petzold's DISKSCAN article, *PC Magazine*, Volume 5 Number 8.

The first thing RN does when it gets the disk data is to check whether the drive requested is a SUBST drive. This can be determined if the drive request entered on the command line (or the default drive, if omitted) passed to function 32h is different from the drive that is returned in the first byte of the Disk Block. DOS returns the actual physical drive of the SUBST drive. Thus, if the requested drive, D:, for example, is a substitute for a subdirectory in drive C:, RN detects the charade and exits with a "Drive not supported" message. Support for SUBST would entail extra fancy footwork—an unwarranted addition to an already long program.

DISK LAYOUT Before discussing how RN uses the Disk Block, it would be well to review how disks are laid out. Disk information is grouped into sectors, 512 bytes each for most disks, though 1024 bytes occasionally. Sectors are then grouped into clusters and will normally vary from two sectors per cluster for floppy



**Table 1:
File Attributes**

01H	Indicates that the file is marked read-only. This value can be used with other values below.
02H	Indicates a hidden file. The file is excluded from normal directory searches.
04H	Indicates a system file. The file is excluded from normal directory searches.
08H	Indicates that the entry contains the volume label in the first 11 bytes. The entry contains no other usable information and may exist only in the root directory.
10H	Indicates that the entry defines a subdirectory.
20H	Indicates an archive bit. The bit is set on whenever the file has been written to and closed. It is used by the BACKUP and RESTORE commands for determining whether the file was changed since it was last backed up. This bit can be used along with other attribute bits.

■ UTILITIES


Table 2: Undocumented DOS Interrupt 21h Function Call 32h Information
DOS INT 21h Function Call 32h—Get "DOS Disk Block"

On entry	Register contents
AH	32h
DL	Number of disk drive (0 = default, 1 = A, etc.)
On return	Register contents
AL	= 00 if drive exists, FFh for invalid drive
DS:BX	Pointer to DOS disk block

Description The DOS disk block contains the following information at the indicated offsets of DS:BX

Offset	Type	Data
00	Byte	Drive: 0 = A, 1 = B, etc.
01	Byte	Unit within driver (0, 1, 2, etc.)
02	Word	Bytes per sector
04	Byte	Sectors per cluster - 1
05	Byte	Cluster to sector shift
06	Word	Number of reserved (boot) sectors
08	Byte	Number of file allocation tables
09	Word	Number of root directory entries
0A	Word	Sector number of cluster 2 (cluster 2 is first data cluster)
0D	Word	Number of clusters + 1 (or last cluster number)
0F	Byte	Sectors for FAT
10	Word	Sector number of directory
12	DWord	Address of device header
16	Byte	Media descriptor byte
17	Byte	Zero if disk has been accessed
18	DWord	Address of next DOS disk block (FFFF if last one in chain)

pies up to eight sectors per cluster for some hard disks. The start of the road map for the disk lies in the root directory, which has a fixed length and physical position on the disk. The directory length for hard drives is usually 512 entries by 32 bytes per directory entry, and the directory position will vary with the size and format of the media. We don't need to guess, however, about the disk layout: the Disk Block

function call returns with all the numbers necessary to determine the location (word 10h) and size (word 09h) of the root.

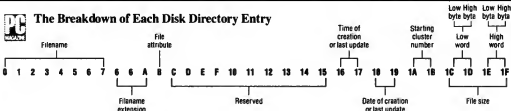
Other subdirectory information can be gathered from the root directory. Each directory record is 32 bytes long (see the diagram "The Breakdown of Each Disk Directory Entry"). Each record will be either the name and starting location of a regular file or of a subdirectory; indeed, subdirec-

tories are simply files with a special attribute. The distinguishing attribute is found in the 11th byte of each directory record. Since RN is only concerned with directories, it ignores any entries that do not have the directory attribute of 10h. The next most important information in the root directory record is the starting cluster number, which is in bytes 26 and 27.

The starting cluster address is the first key to finding the subdirectory, but it's only a start. More often than not, a file will

■ Subdirectories are simply files with a special attribute in the 11th byte of each directory record.

need more space than is allocated to one cluster of disk space. The FAT is in charge of delegating or chaining together the multiple sectors into one file. The FAT either points to the next cluster of data in the chain or indicates its end with a special signature. To complicate matters, however, there are two different types of FATs: 12-bit for "small disks," floppy, or 10-meg hard disks, and 16-bit for anything larger. Twelve bits can address numbers up to 4096, and 16 bits can address up to 65,536, reflecting the larger cluster capacity of the 20- and 30-megabyte drives. You can assume you're dealing with a disk with a 16-bit FAT if the last cluster number returned in word 0Dh of the Disk Block is greater than 4086 (4096 minus a few bytes for status codes).


The Breakdown of Each Disk Directory Entry


PRODUCTIVITY

[illegible]

(RM) ASM continues.

(RN ASM continues)

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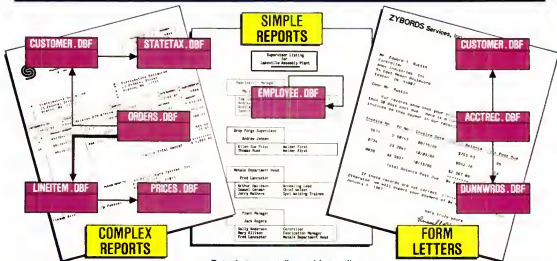
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(RN ASM continues)

```
jeo5832y4ge9 3g036759QUJ$%P(*C%*HJC #&#NR#9mwy 867on87OM963560 89 Q35v t30t02 MOuy09y340 (*C&08435m896)(Y*Y*&G yihyg8097)(*&(*C&08435m896)(Y*Y*&G&C&RGTryern n y j8e9y0ty0tm04ym007yrton8 *)((&)*C&&&&&C&&&&&&&&&&&&&&&&jeo5832y4ge9 3g036759QUJ$%P(*C%*HJC #& R#9mwy 867on87OM963560 89 Q35v t30t02 *P(C97yvgq#9%P(*C%*HJC #&N R#9YY*&G M y09y340 yihyg8097)(*&(*C&08435m89cR
```

832y4g e9 3g036759QUJ5*r
P(c%*HJC #&N R#9
867on87 OM96yw
89 Q35v t30tO

(RN ASM continued)

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[illegible]

(RN_ASM construct)



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The modem number for PC-IRS is (212) 696-0360. Set your modem and communications software to use 1200 (or 300) bps, 8 data bits, 1 stop bit, no parity. Files with a .COM, .EXE, or .ARC extension require that you also use the Xmodem error-checking protocol; files with .ASM or .BAS extensions can be downloaded using either regular ASCII or Xmodem.

If you use the Xmodem protocol, you can download RN.COM directly, saving typing or downloading either the .BAS or the .ASM version. RN.BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create RN.COM when run once in BASIC. RN.ASM, also listed both here and on PC-IRS, allows you to modify the program but also requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM RN;
LINK RN;
EXE2BIN RN RN.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.



Michael J. Mefford

RN Command

1987/No. 16 (Utilities)

- Purpose:** Simplifies creating, removing, renaming, hiding, unhiding, and changing to directories. Also sets/resets the read-only and archive bits of all files within a directory, and reports filecount and space allocated. Allows immediate call-up of DR.COM (Vol. 6 No. 14) for handling individual files.
- Format:** RN [d:] [/I]
- Remarks:** RN can be entered either as an immediate command at the DOS prompt, or it can be installed on a hard disk (using the /I option) with a memory-resident database of directory information that speeds up its subsequent operations. If no drive (d:) is specified, the current drive is assumed.

If installed, RN should be loaded before *SideKick* and any other uninstalleable memory-resident programs. (RN cannot be deinstalled without rebooting.) The program requires 128K RAM operating room; the database, if used, occupies approximately 14K. RN cannot be installed up from within an application with a "hot key"; it can be accessed only from the DOS prompt. Pressing Esc terminates RN's operations.

When issued, RN.COM brings up an alphabetized directory tree with the current listing highlighted and a menu listing the function keys used for its various directory services. The directory highlight bar is moved one entry at a time by the Up Arrow and Down Arrow keys, and in larger increments by the Ctrl-PgUp and Ctrl-PgDn, PgUp and PgDn, and Home and End keys. The highlight bar should be placed on the directory to be affected by the subsequent function key.

When renaming (F2) and creating (F3) directories, do not enter the backslash (\) character but include it in figuring the maximum path length (63 characters). Rmdir (F4), if you confirm at its warning prompt, deletes all files within the directory (unless they are marked read-only) before removing it. Hide/Unhide (F5) affects the directory name only, not the individual files. F6 and F7 (mark/unmark as read-only and set/reset the archive bit) toggle these bits on all files within the directory. F8 updates the directory database if changes are made outside RN, and F9 gives a file count together with the space allocated to a directory's files. F10 calls DR.COM.

Note:

F2 (Rename Directory) require DOS 3.x.

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■ UTILITIES

around the disk. The FAT is also read into the second segment workspace, though into a different reserved location. (Incidentally, you will get the same "Drive not supported" message if the size of the FAT or of the root directory does not fit into the confines of RN's workspace.) The FAT is left in memory throughout the subdirectory hunt, thus eliminating time-consuming rereads. Each subdirectory file entry is read into the second segment workspace, one at a time, one cluster per read. These subdirectories are formatted in the same way as were the root entries, with the names of any sub-subdirectories sprinkled in with any normal files. The subdirectories are sniffed out and stored in the code segment's database, again in the same way as the root directory was handled. This continues until the FAT (or rather, RN's copy of it) indicates that the last cluster has been found.

Next, each of the second-level subdi-

■ The FAT is left in memory throughout the subdirectory hunt, thus eliminating rereads.

rectories is searched for sub-sub-subdirectories, and the process continues until every level is stacked in the database. A subdirectory level address that points to the start of each level is maintained, as well, so RN can quickly find the level division of the database. This is used in the sort routine that alphabetizes the database by level. RN then terminates with its neatly stored directory database remaining resident for instant access if all the /I requirements pre-

viously described are met.

If the /I indicator was not found, RN proceeds to format the database into a visual tree. RN can skip all the above disk reading if the resident database is discovered. That was the basic idea of RN's design. The formatting procedure first moves the database into the second segment workspace so the tree can be constructed in the code segment, which simplifies segment addressing via DS.

At this point the entry number fields of the database come into use. The first subdirectory of the root is expanded into the 40-byte record used for the 40-column display by calling on the STORE_NAME subroutine. (The second 40 columns of the screen are used by the menu and message field.) The appropriate line graphic characters and directory name are stored, after which RN looks through the second level stack for a record that has a parent entry number matching the parent or (in the first



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4399 DATA	211.	171.	234.	29.	131.	205.	0.	117.	1997	8260 DATA	209.	209.	14.	132.	3.	117.	247.	1398	1109
4399 DATA	169.	93.	89.	89.	239.	173.	31.	180.	1093	8261 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4399 DATA	205.	96.	67.	3.	31.	149.	0.	3.	7165	8262 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4426 DATA	0.	16.	142.	192.	169.	3.	18.	159.	798	8263 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4436 DATA	204.	169.	239.	16.	243.	169.	14.	14.	1130	8264 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4436 DATA	204.	169.	239.	16.	243.	169.	14.	14.	1130	8265 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4436 DATA	163.	18.	161.	144.	16.	127.	82.	191.	776	8266 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4446 DATA	3.	149.	289.	0.	18.	142.	219.	152.	8267 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109	
4479 DATA	126.	99.	259.	116.	11.	252.	99.	0.	661	8268 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4479 DATA	151.	169.	29.	126.	99.	0.	112.	249.	889	8269 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4479 DATA	14.	31.	79.	192.	92.	3.	159.	169.	8270 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109	
4506 DATA	39.	126.	3.	131.	251.	21.	116.	11.	669	8271 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4516 DATA	166.	196.	0.	249.	227.	0.	67.	0.	698	8272 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4526 DATA	163.	142.	3.	189.	194.	9.	0.	161.	899	8273 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4539 DATA	163.	16.	189.	152.	56.	243.	171.	101.	1121	8274 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4549 DATA	163.	16.	189.	152.	56.	243.	171.	101.	1121	8275 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4579 DATA	245.	194.	149.	66.	0.	67.	89.	89.	1632	8276 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4589 DATA	40.	136.	54.	191.	3.	139.	215.	56.	759	8277 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4579 DATA	242.	118.	17.	46.	169.	2.	169.	131.	967	8278 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4589 DATA	169.	40.	59.	242.	116.	0.	45.	169.	690	8279 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4599 DATA	2.	179.	239.	243.	46.	137.	94.	191.	677	8280 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4599 DATA	3.	94.	49.	295.	0.	124.	3.	3.	534	8281 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4599 DATA	46.	47.	94.	161.	3.	46.	127.	62.	794	8282 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4629 DATA	166.	0.	189.	6.	0.	232.	72.	0.	797	8283 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4639 DATA	129.	90.	32.	116.	0.	179.	44.	779.	737	8284 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4639 DATA	189.	0.	6.	232.	67.	0.	94.	71.	699	8285 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4639 DATA	126.	46.	19.	179.	40.	131.	169.	49.	816	8286 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4639 DATA	46.	47.	94.	161.	3.	46.	127.	62.	794	8287 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4676 DATA	101.	3.	90.	89.	62.	139.	159.	3.	694	8288 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4696 DATA	16.	136.	7.	56.	226.	56.	197.	119.	819	8289 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4696 DATA	16.	136.	7.	56.	226.	56.	197.	119.	819	8290 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4706 DATA	9.	60.	91.	139.	25.	235.	226.	44.	159	8291 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4726 DATA	143.	9.	191.	3.	93.	46.	169.	172.	997	8292 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4736 DATA	69.	32.	118.	1.	179.	229.	249.	199.	1946	8293 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4746 DATA	169.	6.	129.	3.	3.	0.	169.	74.	816	8294 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4756 DATA	3.	252.	86.	6.	31.	251.	154.	82.	797	8295 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4756 DATA	118.	3.	252.	86.	6.	31.	251.	154.	82.	8296 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4779 DATA	139.	39.	154.	3.	79.	159.	243.	172.	639	8297 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4786 DATA	68.	169.	117.	251.	86.	0.	259.	0.	1636	8298 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4786 DATA	126.	3.	172.	46.	24.	117.	117.	89.	77.	8299 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4806 DATA	126.	3.	169.	118.	16.	79.	79.	131.	739	8300 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4816 DATA	126.	3.	169.	118.	16.	79.	79.	131.	739	8301 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4826 DATA	117.	249.	259.	217.	99.	232.	0.	0.	1149	8302 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4839 DATA	114.	4.	239.	249.	195.	83.	225.	253.	139	8303 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4849 DATA	169.	169.	169.	169.	169.	169.	169.	169.	169	8304 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4869 DATA	119.	3.	181.	129.	3.	49.	67.	1.	518	8305 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4879 DATA	177.	169.	246.	241.	177.	49.	246.	225.	151.	8306 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4879 DATA	3.	249.	137.	84.	119.	3.	129.	82.	749	8307 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4889 DATA	119.	3.	181.	129.	3.	49.	67.	1.	518	8308 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4899 DATA	199.	117.	201.	137.	94.	134.	3.	189.	199	8309 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4909 DATA	199.	164.	17.	189.	4.	82.	79.	139.	985	8310 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4919 DATA	22.	99.	204.	169.	189.	6.	189.	6.	189	8311 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4926 DATA	33.	252.	167.	0.	197.	199.	17.	129.	599	8312 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4936 DATA	93.	9.	119.	99.	199.	149.	19.	11.	992	8313 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4936 DATA	205.	119.	199.	199.	199.	199.	199.	199.	199	8314 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4936 DATA	205.	119.	205.	199.	117.	16.	129.	1229	8315 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109	
4936 DATA	93.	9.	119.	99.	199.	149.	19.	11.	992	8316 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4979 DATA	10.	128.	99.	0.	119.	19.	199.	118.	111	8317 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4986 DATA	209.	151.	197.	49.	239.	222.	239.	19.	1344	8318 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
4996 DATA	75.	118.	92.	79.	159.	222.	131.	119.	1999	8319 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
5006 DATA	42.	128.	124.	205.	0.	117.	259.	139.	1619	8320 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
5016 DATA	14.	124.	14.	43.	292.	32.	0.	0.	0	8321 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109
5026 DATA	3.	159.	14.	131.	3.	139.	14.	113.	532	8322 DATA	146.	112.	3.	136.	14.	113.	3.	165.	109

(RN.RAS ends)

case) the root entry number. If it is found, it is expanded and stored in the display record indented two spaces to the right, reflecting the fact that it is a subdirectory. STORE_NAME is a recursive routine that calls itself to store the next level of subdirectory until no more branches are found.

RN returns in the same way to store the rest of the root directory entries after the last subdirectory and any branches are found for the first subdirectory. All that remains to be done is to display the appropriate page of the directory listing and highlight the default directory. The display on the screen is achieved by writing directly to the screen buffer, enhancing RN's already speedy algorithms.

REDUCED-RATE RESIDENCY To reduce or expand the RAM requirements of an installed RN, change the "500" in the

END_RESIDENT equate at the very end of the assembly listing to a number more closely reflecting your needs. If you have only the .COM file, change the offset directly with DEBUG. First decide how many directories you'll ever expect to need and add another 50 directories or so as a buffer (caution: RN does not check to see if there are more directories than it can store, so be a bit generous). Multiply your directory requirements by 20 (there are 20 bytes per record), add 4541 (the length of RN's code plus some string space), and convert the result to hex. SideKick's calculator is handy for this type of addition and conversion. Then enter

DEBUG RN.COM
E 676 yx wx
W
Q

Note that wxyz is the number you calculated above (in hex), but that the word must be stored in the customary byte-reversed order, yx wx.

IN CONCLUSION That's the best of RN. While there are some other interesting routines, most of them have been borrowed and adapted from other programs that I've written for this column. At 4K, RN is a little heavier than most utilities that have appeared in this column, but the nurse's lightning disk reading and instant resident directory map don't come free. When you get a taste of its power, especially when teamed up with DR, I think you'll be glad you've added RN to your utilities collection.

Michael J. Mefford is a contributing editor of PC Magazine.

Why Your Hard Disk May Be Only Seconds Away From Total Failure!

WELCOME TO THE INNER WORLD OF HARD DISKS: WHERE MICROSCOPIC PROBLEMS CAUSE MAJOR CATASTROPHES.

A typical 200-megabyte hard disk contains over 200,000,000 bits. If only one bit changes or fails, you can lose everything on your disk. Hard disks are subject to so many inherent, uncontrollable conditions that random failures occur with alarming frequency. You already may have been tortured by one of these hard disk error messages: **DATA ERROR, GENERAL FAILURE, ERROR READING, WRITE FAULT, BAD SECTOR, SECTOR NOT FOUND, FILE ALLOCATION TABLE BAD, DISK ERROR READING FAT, DISK NOT READY, INVALID DRIVE SPECIFICATION, NON-SYSTEM DISK OR DISK ERROR, READ FAULT, BAD DATA, ABORT-RETRY-IGNORE** — plus hundreds more that we simply don't have space to mention. Here's why:

PROBLEM ONE: OUT OF ALIGNMENT. There are hundreds of circular tracks packed into every inch of your hard disk's magnetic recording media. They are extremely thin, about as thin as a single strand of hair. Perfectly aligned tracks on a new, out-of-the-carton hard disk look like those in figure 1. Your programs read, but never write, to any of the special Track and Sector ID areas shown in black.

When your system has been off and is cold — in the morning, for instance — head positioning mechanics shrink, causing heads to read and write towards the inside. As the unit warms they expand and tend to read and write towards the outside. Add friction, wear-and-tear, play, torquing, repeatability, vibration, irregular platter and surface expansion, etc. — and within a very short time your data, program and system sectors can go out of alignment like those shown in figure 2. This is a continual, serious problem: valuable data may be written so far off current head tracking that it is no longer readable, resulting in devastating errors and lost data.

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PROBLEM TWO: MEDIA AND DISTANCE. The typical distance between the head and the media is about 25 millionths of an inch. By comparison, a smoke particle is about 10 times greater and a human hair is over 100 times greater! Expansion and contraction caused by normal heating and cooling, wear-and-tear, media degradation, vibration, humidity, platter wobble and aging all cause this distance to vary (see figure 3). Read and write quality varies directly with these distance changes.

No matter how carefully the hard disk media was manufactured, there still will be variations in coating thickness, smoothness and magnetic density (see figure 3). Add aging and magnetic retentivity changes, and some spots may change from "good" to "unreliable" overnight. Magnetic hard disks act just like old photos: they fade away — along with your data! Disk Technician is the only total solution to these problems. Disk Technician reads, writes and tests every single bit on the hard disk, occupied or not, using special proprietary testing and repair algorithms to check for soft error rate, magnetic retentivity, and the ability to read and write perfectly. If even the smallest marginally or error is found, Disk Technician will automatically proceed with its complete repair and restoration process. DOS and other programs can only tell you after 10 to 30 errors have been made. Our testing reveals that once a spot makes more than 3 to 5 soft errors, total failure is imminent. Disk Technician's daily preventive testing, repair and recovery is the only real cure.

PROBLEM THREE: POWER. Static electricity, turning power on-and-off, brownouts, surges, spikes and static electricity all can cause the heads to write meaningless "garbage" into whatever tracks they happen to be located over. Although hard disks and computers are designed to minimize accidental head writes, they still occur and cause devastating damage — often wiping out an entire disk. Disk Technician takes a new approach to cure these problems.

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Figure 1* Perfectly aligned tracks. The black areas are "read only." These store critical track and sector ID information. The white areas are data sectors and store your system, programs and data.



Figure 2* Sectors out of alignment with the track. The most frequent cause of lost or unreadable data. See Problem One.



Figure 3* Heads, media and platter. A: The distance from the heads to the media continually changes. B: The magnetic coating varies in thickness and smoothness. C: Magnetic retentivity varies and decays. See Problem Two.

*Magnified and simplified for clarity.

"My hard disk works perfectly. Why do I need Disk Technician?" First-time users are shocked by the large number of errors Disk Technician finds and repairs on disks that seemingly worked perfect — many that were only seconds away from total failure! Every hard disk will lose data — the only question is when. Using daily, Disk Technician can virtually eliminate data losses, costly downtime and user torture. Disk Technician pays for itself many times over. "What is so special about Disk Technician?" Disk Technician is a new category of software: daily prevention software that repairs and maintains hard disks by predicting and correcting failures before and after they happen. This breakthrough artificial intelligence system automatically prevents, detects, repairs and recovers hard disk media failures.

before and after data is lost. It takes less than 60 seconds of operator time daily to use and runs automatically, unattended. Anyone who can press the "RETURN" key can use it. "How does Disk Technician really work?" Simply stated, Disk Technician reads, writes and tests every single byte and bit on the hard disk, occupied or not, using special proprietary testing and repair algorithms that can predict and correct a failure before or after it happens. This makes certain that every bit is tested for soft error rate, magnetic retentivity, and the ability to read and write perfectly. When Disk Technician repairs an area, it specially monitors that spot on all subsequent tests to make certain it stays repaired. • You don't need to reformat • You don't need to clobber data • You do need to run Disk Technician daily!

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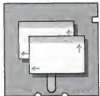
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■ ENVIRONMENTS ■ CHARLES PETZOLD

WELCOME TO THE POST-DOS WORLD



DOS is dead; long live OS/2. Here's the first installment of a new column that will keep you abreast of the latest developments in the new IBM operating system.

OS/2, Microsoft Windows, protected-mode, virtual-86 mode, applications program interfaces, multitasking, messaging, interprocess communication, dynamic linking, threads, queues, semaphores. . .

Keeping up-to-date with the changing operating system environments for the IBM PC has recently become more difficult than ever. Programmers and other interested observers suddenly have a whole lot of new stuff to learn. Despite everything we know about DOS, we're all back in first grade again.

Environments is a new column that will be devoted to beating a clear path through this jungle, to telling you what's happening and why, to exploring the new concepts and getting you up to speed. More specifically, it's about OS/2, Windows, and whatever else may come along. Environments is not about DOS, but about the post-DOS environments for the PC.

LIFE AFTER DOS? Though still the dominant operating system for personal computers, MS-DOS is a dinosaur. By not adapting to the changing needs of program developers and users, DOS has become a dead end on the evolutionary path and is headed for extinction. It's played out, unfixable, and hopelessly inadequate for supporting the applications of the 1990s. When otherwise sensible people get excited that DOS 3.3 finally lets you turn off the batch file echo mode without first displaying the "Echo Off" message, you can sense in their very diminished expectations that the end is near.

There are some, of course, who believe that the only thing DOS needs is a good RAM-resident program manager. Several other software vendors are trying to make do by developing appendages to DOS that exploit the virtual-86 mode of the 80386 microprocessor. And still others continue to predict (as they have been doing for many years now) that UNIX is the only operating system that can take us into the future. Should any of these environments make significant inroads and become a real factor in the PC market, it too will become a topic for this column.

But right now it appears that the successor to MS-DOS will be Microsoft's Operating System/2. [See the author's article on OS/2, "Smooth Operator," PC Magazine, Volume 6 Number 13.—Ed.] OS/2 has momentum, OS/2 has IBM support, and most important, OS/2 has a lot of really neat stuff in it. It's an operating system that programmers can work with, rather

than work around. In comparison with OS/2, DOS hardly deserves to be called an operating system at all.

THE OS/2 ENVIRONMENT From the programmer's perspective, an operating system is an environment that provides programs with the means to use the hardware of the computer. The operating system is also the program's link to the outside world. This link is made through the operating system's applications program interface (API). The API answers the questions: "How does my program talk to the operating system?" and "What can the operating system do for me?"

The only substantial thing MS-DOS can do for programs is access files without directly accessing the disk. MS-DOS is limited to the 1-megabyte memory space of the 8088 (of which generally 640K is available for DOS and applications programs), and it can run only one program at a time.

OS/2 drastically changes this environment. The basic memory space is 16 megabytes, and virtual memory (that is, memory that is swapped to disk) allows programs to use more memory than actually exists in the machine. Multiple programs are efficiently and safely multitasked. Further, OS/2 allows programs both to create multiple threads of execution (with the different threads running simultaneously) and to communicate with other programs.

But in changing the environment in which programs run, OS/2 also changes the API and the programming rules. You

■ Programmers suddenly have a lot of new stuff to learn. Despite everything we know about DOS, we're all back in first grade again.

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may, for example, have the DOS interrupt 21h function calls down pat and know all the tricks for crash-proofing your RAM-resident programs, but OS/2 programs don't even use interrupt 21h and every OS/2 program becomes a RAM-resident program! Such changes, which will involve a tutorial on programming for the protected-mode environment of OS/2, will be the subject of this column for the next several months.

OS/2 will also eventually include a version of *Microsoft Windows*. This will be called (according to IBM) the "Presentation Manager" or (according to Microsoft) the "Windows presentation manager." (I hope that the two companies will keep their code more consistent than their capitalization.)

The OS/2 Presentation Manager is a graphical-based windowing environment with extensive built-in logic to facilitate the use of graphics and various features of the user interface, such as menus and dialog boxes. The Presentation Manager has its own API, which is very different from the API of the OS/2 kernel. With *Windows*, the API answers not only the question "How does my program talk to the operating system?" but also the question "How does the operating system talk to my program?"

When we discuss operating system environments, we're also talking about the user's environment, namely, the user interface. Although the program's environment and the user's environment are often thought of as separate and distinct aspects of the operating system, they are closely related.

For instance, the "anything goes" programmer's environment of DOS has certainly fostered some of the best applications programs ever designed. These programs, however, have often employed unnecessarily inconsistent user interfaces and have taken a very cavalier approach to memory. Moreover, because of their extensive direct use of the PC's hardware, these applications have been resistant to multitasking.

The more rigorous and extensive API of the OS/2 kernel will foster programs that may look much the same as their DOS counterparts, but they will make more efficient use of memory and be multitasked

with other programs running under OS/2.

The user interface of the OS/2 Presentation Manager, with its windowing and high level of command consistency, requires a very different API. This API includes routines required for this consistent user interface and manages the windows through "messages" sent to the various programs. Exploring the relationship between the program's environment and the user's environment will be a recurring theme in this column.

THE BIG TRANSITION The transition from MS-DOS to OS/2 will be the most difficult, the most confusing, and the most painful event in the short history of the personal computer. OS/2 essentially splits the community of PC users in half: those who can run OS/2 on their machines and those

■ The transition from
MS-DOS to OS/2 will be
the most difficult, painful
event in the history of the
personal computer.

who can't. OS/2 runs under the protected mode of the 80286 and 80386 microprocessors, and it will not run on machines without an 80286 or 80386. OS/2 is for the PC AT (and compatibles), the PC-XT Model 286, and the PS/2 Models 50, 60, and 80. It will not run on the original PC, the PC-XT, or the PS/2 Model 30.

There are enough 80286 and 80386 machines around now to provide a significant hardware base for OS/2 software, but people with older 8088- or 8086-based machines are going to feel cut off from the action. Because current DOS programs will not run in protected mode, OS/2 is really for new programs using the new API and following the new rules. The transition period between DOS and OS/2 will be eased somewhat by the "DOS Compatibility Box" feature of OS/2. This will allow you to run DOS programs under OS/2 in an environment similar to DOS 3.3. MS-DOS

■ ENVIRONMENTS

has accumulated such an extensive software base that it might seem inconceivable that any other operating system can knock it from its throne. But this is exactly what will happen because DOS cannot grow in the directions the future requires. Ultimately, DOS will play a role in the market much like CP/M-80 today: an essentially static operating system with lots of applications but no real future or growth.

The transition to OS/2 will begin in the first quarter of 1988, when IBM is scheduled to begin shipping retail versions of OS/2 1.0. At the same time, IBM (and

■ Microsoft's \$3,000 price tag for the OS/2 Software Development Kit is a real slap in the face to programmers.

possibly also Microsoft) will make available technical documentation and programmer's kits. Right now, Microsoft has an OS/2 Software Development Kit to let programmers start working with OS/2. The only real problem with this kit is that it costs \$3,000.

A ROCKY START Although I believe OS/2 will be a success, I am troubled about some self-destructive initial decisions by Microsoft. For starters, Microsoft's \$3,000 price tag for the OS/2 Software Development Kit is outrageous. Obviously the major software vendors (the Lotus, the Ashton-Tates) can swallow the \$3,000 cost without a burp. For the rest of us, it really hurts. It's a real slap in the face to less-affluent software vendors, nonprofessional programmers, and even to some corporate programmers. Much PC programming in corporations is done in an informal manner in which the purchase of obvious necessities (such as a *DOS Technical Reference* manual) often require elaborate memos justifying the expense. Try justifying the purchase of a software package that costs as much as a new PC.

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The high cost of the OS/2 Software Development Kit also puts me in the extremely awkward position of running a tutorial on OS/2 at a time when most of my readers cannot duplicate what I do on their own machines. I can truthfully say that I don't like this any more than you do.

Another significant problem that became apparent with the official announcement of OS/2 involves *Windows*. While IBM was ultimately convinced to include a

■ Microsoft was forced to make substantial changes to *Windows* for OS/2.

version of *Microsoft Windows* in OS/2 (where it will be called the Presentation Manager), Microsoft was forced to make substantial changes to *Windows*.

This was not supposed to happen. One of the big selling points Microsoft has long been using to convince software developers of the viability of *Windows* under DOS was the touted role the program was to play in "future DOS" (as it was then called). Programmers who wrote programs for *Windows* were supposedly writing programs that would someday run under protected mode in Microsoft's future operating system, the new OS/2.

To programmers who were becoming impatient with the long wait for OS/2, this was an appealing lure. But it's no longer true. The OS/2 *Windows* Presentation Manager has a significantly different API from that of the version currently on the market of *Windows* for DOS.

Although programmers who have already explored the DOS version of *Windows* certainly have a head start in programming for the OS/2 *Windows* Presentation Manager, some extensive revisions to existing *Windows* programs lie ahead. It also appears that the long wait for the original version of *Windows* (announced in 1983, released in 1985) will be replayed as we now wait for the OS/2 *Windows* Presentation Manager.

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TOO COMPLEX? The success of personal computer operating systems has always depended on the availability of application programs that run under them. For OS/2, this is almost a sure bet.

But traditionally, personal computer operating systems have also greatly benefited from the work of non-professional (often self-taught) programmers. These are the programmers who write the public-domain software that appears on bulletin boards, the programmers working for corporations who can ease the integration of PCs in the office, and, in some cases, the programmers who find that they've written a program for which people will actually pay real money.


In short, a personal computer operating system can be truly successful only if people can hack away at the thing.

With DOS, that's relatively easy. You can spend a couple of hundred dollars for the Macro Assembler, the DOS *Technical Reference* manual, and one of the PC *Technical Reference* manuals, and essentially you have the same tools the pros use. The results have been incredible and have enriched us all.

Microsoft Windows, on the other hand, requires a \$950 initial outlay: \$500 for the Windows Software Development Kit and \$450 for the Microsoft C Compiler, together with an investment of several months (even for the most experienced programmers) just to make sense of the documentation.

With OS/2, the situation is worse. Even after the introduction of OS/2, the tools and reference material will not be cheap. And for people who come from a DOS background, OS/2 initially appears forbiddingly complex.

There are some who believe that the age of the nonprofessional programmer has passed, that the ability to program for the new environments requires assimilation of dozens of manuals, formal training, and costly seminars. The message they're sending is as clear as if the manuals were stamped, "Nonprofessional programmers need not apply."

I don't believe this, and you and I are going to prove them wrong. 

Charles Petzold is a contributing editor of PC Magazine.

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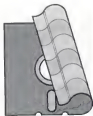
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UNDOCUMENTED FUNCTIONS

I have discovered five undocumented @ functions in *Framework II*: @version, @reporterror, @hyper, @execparms, and @exec.

@version or @version() requires no parameters. Just enter it into a spreadsheet cell and you will get a three-digit number. I believe this number is used by Ashton-Tate as an in-house version number. In any case, Version 1.0 should give you either 126 or 137, and Version 1.1 should give you 140.

@reporterror(n) displays an error message in the message area. The n parameter is a number from 1 to 500. For example, @reporterror(1) displays the error message "Memory is full."

@hyper() takes as a parameter either the value #ON or the value #OFF. I do not know what it does.

@execparms can take up to 16 parameters. These can be numbers or frame names, and the function will display the number of parameters. For example, @execparms(2,5,"frame name",4,4) will display the number 5.

@exec(frame name, n) takes a frame name as the first parameter and a number greater than 0 as the second parameter. Be especially careful when you experiment with this function because it will hang up the computer.

I have not found a way to use the last three functions, but @execparms and @exec appear in the paste macro (Alt-F8) in the Library frame.

Sum Kah Meng
Singapore

```

\c      {getlabel "Enter filename to read into the worksheet: ",INFILE)
        {onerror NOINFILE}
        {goto}INFIELD      <-- INFIELD is cell where new file
                             will be obtained.
INFILE  budget
        ~{onerror OK}
        {goto}XXXXX      <-- Deliberate error to cancel
        {emc}              error trapping.

        . . macro
        continues . .

NOINFILE {BEEP}FILE      <- One space after "E" in "FILE".
MISSFILE budget
        NOT FOUND! PRESS [RETURN] AND REHY! (?)
        {emc}
        {branch \c}
  
```

Figure 1: A 1-2-3 macro that traps an error and then cancels error trapping if there is no error.

I won't even begin to guess how Mr. Meng came across these functions, but they all do what he says they will do. @exec completely disables the keyboard, so you can't even do a warm boot. The only thing @hyper would do for me is display the message: "You are as deep as you can go in this frame." And, sure enough, @exec and @execparms are used in the paste macro. Only the folks at Ashton-Tate must know for sure what this is all about.

ERROR TRAPPING IN 1-2-3

The expanded macro language in Release 2 of 1-2-3 has an {onerror} function that lets you write macros that will continue smoothly even if there is an error. It works by causing macro execution to branch to a certain routine when an error occurs. With this technique, you can anticipate particular errors and write routines to deal with them. Error trapping stays in effect until an error occurs, another {onerror} function

appears in the macro, or the macro ends.

What happens, however, if the error you anticipated doesn't happen? The macro continues to execute, but error trapping stays in effect. Since the macro language can't distinguish between different kinds of errors, any error that thereafter occurs will cause macro execution to branch back to the original correction routine. If you didn't get the error you originally anticipated, but later get a different one, that correction routine may be wholly inappropriate. Ideally, your macro won't run into unanticipated errors, but if it does, it may make more sense for it to stop dead in its tracks rather than loop back to a correction routine that doesn't make sense.

The macro in Figure 1 illustrates the problem and provides a solution. The routine prompts the user for a filename to combine into the current worksheet. If the user types a filename that doesn't exist, there will be an error. In anticipation of this

■ SPREADSHEET CLINIC

possible error, the macro contains the statement {onerror NOINFILE}. If the file the user asked for doesn't exist, the error will no longer stop the macro. Instead execution branches to the NOINFILE routine. This routine displays a message to the user telling him the file he wanted wasn't found and asking him to try again.

The macro then starts over again with {branch %C} and sets up the same error-trapping routine. If the user now enters the name of a file that exists, the macro will combine the contents of that file. The trouble is that error trapping is still in effect, and an error—any error—will cause execution to branch to NOINFILE. If you get a surprise error later on in the macro, the NOINFILE routine could be far worse than simply shutting down the macro.

Therefore, the macro shown in Figure 1 contains the {onerror OK} statement that cancels the previous error-trapping condition. In the next line of the macro, there is a deliberate error (the range XXXXX doesn't exist) that results in a branch to OK and the cancellation of error trapping. The OK routine is a simple Escape that does nothing and can be thought of as an {onerror} routine. The macro can now continue without the danger of branching to the wrong place because of an unanticipated error.

Anders Forssell
Helsingborg, Sweden

This technique represents an elegant solution to an inelegant problem. Lotus really should have provided an OFFERROR routine to complement ONERROR, and Mr. Forssell's macro allows us to correct that oversight.

SKIPPING COLUMNS IN PRINTING

In the Spreadsheet Clinic for Volume 6 Number 7, there was a submission on how to print selected columns of a 1-2-3 worksheet. The trick was to use /Print Printer Options Borders Columns as a means to ensure that part of the worksheet was printed in the leftmost columns. That way, whatever other part of the worksheet you wanted to print could be defined as the print range.

Although this is a good trick for Release 1A, there is an easier way to do it in Release 2. Simply hide the columns you

don't want to print. They won't appear in the printout either.

Andrea McFarlane
Saint John, New Brunswick
Canada

This is true. However, the technique in the earlier submission is still useful in Release 2 if you want to skip a number of rows rather than columns. Release 2 doesn't let you hide rows, but you can skip some at print time by using Options Borders Rows. Still, the simplest way to print selected rows may be to make a copy of your worksheet, delete the rows you don't want to print, print that copy, and then throw it away.

QUIRK IN 1-2-3 @@ FUNCTION

In your March 31, 1987 column (Volume 6 Number 6) you invited readers to explain a quirk in 1-2-3's @@ function that Eric Marcus reported. (To see the quirk in action, create the small spreadsheet in Figure 2. The formulas contained in cells C5 and C7 are displayed to their right. Normally, these two cells should have the same values, since the formula in C7 is nothing more than an indirect reference to C5. However, if you edit C5 and change the formula to +C3*10, for example, you will notice that C5 becomes 20, but C7 changes to zero. Now, if you enter different values in C3, C5 will still display the correct value, but C7 will display the correct value for the previous value of C2.—Ed.)

This error is due to 1-2-3's order of calculation. Normally, during natural-order recalculation, the program is careful to recalculate cells in the correct order, so that intermediate results that are used in other formulas will be updated first. In order to do this, 1-2-3 must keep track of which cells are needed to calculate the values for other cells.

However, in the case of the @@ function, 1-2-3 knows only that the value of the function depends on the cell specified in the function. It apparently does not know that the function value itself depends on the values of the cells whose addresses are included in the function. Thus, any cell using the @@ function is in danger of being recalculated before the values it depends on are updated.

In the case in Figure 2, the value in C7

	C	D	E
3	2		C5
4			
5	10	<===	+C3*5
6			
7	10	<===	@@(E3)

Figure 2: Formulas that demonstrate a quirk in the 1-2-3 @@ function.

may be incorrect because 1-2-3 thinks it depends only on the value of cell E3, which it references, whereas it actually depends on the value of C5, which E3 references. 1-2-3 appears to lose track of the connection between E3 and C5 with respect to order of calculation. Actually, as pointed out in the earlier column, sometimes the results in a cell that uses the @@ function will be correct. This appears to be because the order of recalculation that 1-2-3 chooses when it thinks order makes no difference may just happen to be the correct one!

In fact, it appears that the most recently entered or modified cell is the one that is calculated last. The following experiment demonstrates this:

Enter the number 1 in cell B2.

Put the string A2..B2 in cell A1.

Put the string A2..B2 in cell B1.

Enter the formula @sum(@a1)) into cell A2.

Enter the formula @sum(@a1b1)) into cell B2. (It's important that the number 1 have been there first.)

Note that cells A2 and B2 both display the same results: 1.

Hit F9 to recalculate, and notice that A2 now displays 2 and B2 displays 3, indicating that the formula in A2 has been computed first (as the sum 1 + 1) and that the result, 2, was added to the contents of B2 to get the result of 3.

Hit F9 two more times and you will see the numbers change to 5 and 8, then 13 and 21. This indicates that B2, which was entered last, is calculated last.

Move the cursor to A2, hit F2 to begin editing it, and then just hit Return. Now, both cells display the value 21. But if you start hitting F9 it is now A2's turn to display the larger number. You will get 63 and 42, 168 and 105, and so forth. Apparently the last cell entered is the last cell recalculated when 1-2-3 doesn't realize there

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is a preferred order for recalculations.

Actually, this example is pathological in that there is *no* correct order of recalculation, because this is a circular reference. 1-2-3 usually catches these and displays the CIRC message. However, in the case of indirect references made by the @@ function, the program doesn't realize that the reference is actually circular.

In fact, it's not clear that 1-2-3 could recognize such circular references. The cell referenced in the @@ function could contain a string formula that depends on other cells, which themselves depend on other cells, and so on. It's not easy to establish the cells to recalculate before evaluating an @@ function.

Andrew F. Siegel
Seattle, Washington

Are you still out there, Mr. Marcus? The next letter also adds some clarification to this problem.

MORE ON THE @@ QUIRK

The problem that Mr. Marcus pointed out in his submission arises from the order in which 1-2-3 calculates the values of different cells [see Mr. Siegel's letter above—

■ In the case of indirect references made by the @@ function, the reference is actually circular.

Ed.]. This can be easily demonstrated. If you change the order of calculation in the spreadsheet in Figure 2 to rowwise, 1-2-3 will be forced to calculate the value of C5 before that of C7 and you will get correct results.

When you change the formula in cell C5 the value in cell C7 becomes 0. This happens because when 1-2-3 first begins a recalculation, all cells to be recalculated are assumed to be zero. If the cell with the @@ function is calculated before the cells it depends on are recalculated, it reflects their value, which is zero.

R. Andrew Killinger
Denver, Colorado

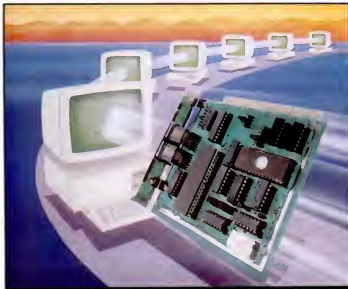
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■ PAUL SOMERSON



USER-TO-USER

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NUMLOCK WARNING

I'm constantly forgetting which NumLock state my PC is in when editing files. After a few inadvertent PgUps and Deletes I would often end up with a file altered in some strange way.

To solve this problem I wrote the resident CLICK.COM program to make a computer beep when the numerical keypad is used to type numbers. Now a short beep reassures me that I am in fact typing numbers when I think I am, and not blasting

around the screen randomly deleting things instead.

You can create **CLICK.COM** by assembling the .ASM source code in Figure 1, or running the BASIC program in Figure 2. It occupies less than 120 bytes when

```

CLCK:ARW Revlin Miller
/*CLCK:ARW is a memory resident program that sounds a siren
when whenever the numeric keypad is used in edit mode.
It uses LOCK state (BROW LOCK on, shift key off) or
/*Brows BROW LOCK state (BROW LOCK off, shift key on).
Assemble and link with MAKR, then run through EXEC22R to
convert to a COM file.

: THIS SEGMENT LOCATES THE KEYBOARD FLAG
FLAG: SEGMENT BSS
ORG 174
KEYFLAG DB 7
FLAG: DSDB

CLICK8: SEGMENT
ADDRESS C:\CLICK8.D6;FLAG
ORG 8
ENDORG: EQU 8
ORG 188
PROC FAR
START:
PUSH DB
PUSH AR,AR
PUSH AR
KEYRLEN WILL MAKE NECESSARY
CHANGES TO CONVERT TO
A COM PROGRAM
JMP DB 181T
/*STANDARD CODE .END

ENTRY:
PUSH AR
PUSH CH
PUSH DB
MOV AX,FLAG
MOV DB,AR
: PUT COPY OF KEYBOARD FLAG
: IN AL REGISTER
MOV AL,KEYFLAG

: CHECK FOR LEFT/RIGHT DRIFT KEY. IF DEPRESSSED THEN TOGGLE THE
/*HMOCK SET BIT IN THE COPY OF KEYBOARD FLAG CONTAINED IN AL
TEST AL,B10
JLSE P01F1 SET DEPRESSSED ?
JN P01F1
: IF NO THEN CHECK SLEEP DRIFT
MOV AL,286
TEST AL,286
JLSE P01F2
/*LEFT DRIFT KEY DEPRESSSED ?
JN P01F2
: IF NOT THEN SLEEP
TEST AL,286
JLSE P01F3
/*HMOCK SET THE HMOCK BIT
: DETERMINE PARAGRAPH USING EXCLUDING THE TEST CODE
MOV DB,OFFSET LASTTIME + SECOND + 151 SWS 4
MOV AR,B11T
CALL DB0 STAY RES FUNCTION
PFI 21H
LAST 21H
MAIN
ENDP
CLICK8
END START

```

Figure 1: *CLICK.ASM* source code to create resident *CLICK.COM* program that beeps when the numerical keypad is used to type numbers.

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APRIL 28, 1987



HANDS ON

BY JONATHAN MATZKIN

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PRODUCTIVITY

■ USER-TO-USER

```
100 ' Program for creating CLICK.COM -- Kevin Miller
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 8:FOR C=1 TO 16:READ A$:TTL=TTL+VAL("6H"+A$):NEXT
130 READ S:IF S=TTL THEN 150
140 PRINT "DATA ERROR IN LINE";B*16+190;" -- REDO":END
150 TTL=0:NEXT:RESTORE
160 OPEN "CLICK.COM" AS #1 LEN=1:FIELD #1,L AS D$
170 FOR B=1 TO 8:FOR C=1 TO 16:READ A$
180 LSET D$=CHR$(VAL("6H"+A$)):PUT #1:NEXT:READ DUMMYS:NEXT
190 CLOSE:PRINT "CLICK.COM CREATED"
200 DATA 16,20,C0,50,EB,50,90,50,51,1E,B0,40,00,8E,D8,A0,1761
210 DATA 17,00,A0,01,74,02,34,20,A0,02,74,02,34,20,A0,20,966
220 DATA 74,20,24,60,3C,47,7C,22,3C,53,7F,1E,00,06,E6,43,1724
230 DATA B0,EB,03,06,42,0A,C4,E6,42,04,61,8A,E0,0C,03,06,2277
240 DATA 61,B9,00,13,E2,FE,8A,C4,E6,61,1F,59,50,2E,FF,2E,2133
250 DATA 52,01,00,00,00,00,FA,B0,09,04,35,CD,21,2E,09,1E,1202
260 DATA 52,01,2E,8C,06,54,01,B0,09,0A,07,01,B4,25,CD,21,1194
270 DATA BA,16,00,B4,31,FB,CD,21,00,00,00,00,00,00,00,926
```

Figure 2: CLICK.BAS program to create resident CLICK.COM that beeps when the numerical keypad is used to type numbers.

installed and shouldn't interact oddly with other resident programs.

Kevin Miller
Longmeadow, Massachusetts

CLICK.COM contains several smart tests to make sure it doesn't beep at the wrong time. However, if your keyboard is too quiet for you and you want it to beep at every keypress, create CLICK.COM and then jump around all the tests by putting CLICK.COM on the same directory as DEBUG.COM and typing

```
DEBUG CLICK.COM
E 10A EB 20
W
Q
```

COMMAND NESTING

Since batch files execute one slow line at a time, it's desirable to make them as short as possible. But checking for user inputs usually means a cascade of IF == statements, which can waste space and time. However, I've discovered a real shortcut.

Let's say you were running a batch file named RUNIT.BAT that checks its pa-

rameters and then runs a program called RUN.COM using the validated parameters. The only valid parameters for RUN.COM are A and B. The usual way to check for parameters would be

```
ECHO OFF
IF %1.==A. GOTO OK
IF %1.==B. GOTO OK
IF %1.==A. GOTO OK
IF %1.==B. GOTO OK
GOTO INVALID
:OK
RUN %1
GOTO END
:INVALID
ECHO INVALID -- USE "A" OR "B"
:END
```

But you can nest the IF statements to speed things up, as shown in Figure 3.

The nested IF command will work with any combinations of EXIST, ERRORLEVEL, STRING1 == STRING2, and NOT. The only limitation is the command line length of 130 characters.

Tom Cervenka
Pontiac, Michigan

This comes in very handy when using IF ERRORLEVEL TESTS. For instance, if you need to figure out which drive you're

```
ECHO OFF
IF NOT %1.==A. IF NOT %1.==B. IF NOT %1.==A. IF NOT %1.==B. GOTO INVALID
RUN %1
GOTO END
:INVALID
ECHO INVALID -- USE "A" OR "B"
:END
```

Figure 3: An example of nesting IF statements to speed up batch file execution.



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■ USER-TO-USER

on, you can use a batch file like DRIVER.BAT:

```

@ECHO OFF
DRIVE
IF ERRORLEVEL 0 IF NOT ERRORLEVEL 1 GOTO Drive_A
IF ERRORLEVEL 1 IF NOT ERRORLEVEL 2 GOTO Drive_B
IF ERRORLEVEL 2 IF NOT ERRORLEVEL 3 GOTO Drive_C
IF ERRORLEVEL 3 GOTO Display_Then_Driver_G

```

To make this work, create a tiny .COM file called DRIVE.COM. Type in the following DEBUG script using a pure ASCII word processor or the DOS COPY.COM COMMAND, and call it DRIVE.SCR.

```

N DRIVE.COM
E100 B4 19 CD 21 B4 4C CD 21
RCX
B
W
Q

```

Make sure you hit the Enter key after each line, especially the last one (with the Q). Then type

DEBUG < DRIVE.SCR

DEBUGGING DEBUG

I use the DOS DEBUG program quite often. While its D (Dump) command is extremely useful, it won't display "nonprintable" characters in the ASCII collating sequence or ASCII characters above 127, and puts periods on-screen instead. This makes it difficult to keep track of exact data locations without having to count the periods.

I debugged the DEBUG program and found that it displays only characters from ASCII 32 through ASCII 126; for all others it prints a period. I modified DEBUG so that it displays the characters from ASCII 14 through 255 (but not ASCII 26), since characters lower than ASCII 14 and character 26 can do unusual things such as beeping or printing tabs, carriage returns, and line feeds.

To do this, first copy DEBUG.COM and name the copy DEBUG2.COM. Then get into DEBUG:

DEBUG DEBUG2.COM

Find out how long the file is by typing

RCX

and hitting the Enter key twice. You should see something like

CX 3E19

Take the four-digit hex number following the CX and type

S 100 L3E19 3C 7F

(substituting the four-digit hex number if yours is different from 3E19). Hit the Enter key and you should see something like

61B2:0AFE

61B2:00F2

You're interested in the top number only (here it's 61B2:0AFE). Ignore the first four digits (the ones preceding the colon).

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Take the rightmost four digits and type

E 0AFE

(substituting the four-digit hex number if yours is different from 0AFE). Hit the Enter key. Now, very carefully, type the following keystrokes:

(Spacebar)
0E
(Spacebar)
72
(Spacebar)
(Spacebar)
(Spacebar)
1A
(Spacebar)
75
(Enter)

Then hit W (and Enter) to write the new version back to disk, and Q (and Enter) to quit DEBUG. DEBUG2 will now display virtually all the ASCII characters.

Gary Later
Bucilton, California

You can also change the nonprinting character from a period to anything else. You could replace the period with a space (hex 20) to clean up the display. Or you could make the character darker—with something like the small hex FE box.

Just follow the same process described above—but replace the line

S 100 L3E19 3C 7F

with

S 100 L3E19 B0 2E

Again, you're interested in the top number only; in DOS 3.3 it will be something like

61B2:0B06

Ignore the first four digits (the ones preceding the colon). Take the rightmost four digits and type

E 0B06 B0 FE

(but replace the 0B06 with the four rightmost digits of the top number you saw after entering the S command, and replace the FE with the hex value of the character you want to appear on-screen instead of the default period).

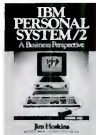
Then type Enter, W (to write), Enter, Q (to quit), and Enter.

DOUBLE DOT DISASTER

It's dangerous for users with rudimentary knowledge of subdirectories to poke around where they're not supposed to be. I recently discovered one who knew what DIR and ERASE did, but hadn't a clue what the . and .. represented in a directory listing. This novice user, who was in a subdirectory one level down from the root, tried to ERASE the mysterious double dot "file" and, of course, ended up deleting all the files in the root directory.

Gerald H. Karran
Lagos, Nigeria

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■ USER-TO-USER

If novice users are going to be fiddling with your system, one simple way to get around this would be to use the DOS ATTRIB.EXE (or Charlie Petzold's ATTR.COM) to make all your important files read-only.

And, since DOS responds with an

Are you sure (Y/N)?

warning when you try to erase an entire subdirectory, you could use DEBUG to patch COMMAND.COM so that it responded with a message like

Now hit the N key!!

To patch COMMAND.COM with DEBUG, first make a backup copy of COMMAND.COM called COMMAND.BAK so that if you make a mistake you can start over. Then type

DEBUG COMMAND.COM

Find out how long your COMMAND.COM is by typing RCX and hitting the Enter key twice. You'll see something like

CX 62DB

Take the four-digit hex number following the CX and type

S 100 L62DB "Are you sure"

(substituting the four-digit hex number if yours is different from 62DB). Hit the Enter key and you should see something like

61B2:5158

Ignore the first four digits (the ones preceding the colon). Take the rightmost four digits and type

E 5158 "Now hit the N key!!"

(substituting the four-digit hex number if yours is different from 5158). Hit the Enter key. Then hit W (and Enter) to write the new version back to disk, and Q (and then Enter) to quit DEBUG. Once you've patched COMMAND.COM, reboot.

SHARE YOUR DISCOVERIES

Tell fellow users about your latest discovery through User-to-User, and we'll pay you between \$50 and \$300, plus an extra \$25 if you submit it on a disk. If you send a disk, please include a printout to ensure against damage. Mail your contributions to User-to-User, PC Magazine, One Park Avenue, New York, NY 10016.

■ NEIL J. RUBENKING

POWER USER



WordPerfect tips and macros for reverse-order printing, autoscrolling, leading, inserting calculations and file lists, macro editing without Library, and a macro help system.

[In Volume 6 Number 7 we invited readers to submit WordPerfect power-user tips, and the enormous response we received testifies both to the program's popularity and to our readers' macro-making ingenuity. Contributing editor Neil J. Rubenking has selected and edited the best of these submissions for inclusion in this double-length special WordPerfect-only column. Others will be included in succeeding regular columns.]

Where desirable to make the macros below more readable, we have altered our style conventions slightly for this issue. Ctrl-G, for example, appears as "G," and <CR> stands for Enter. Angle brackets are used when necessary to show keystrokes and keystroke sequences where normal word spaces might lead to users' entering them by mistake.—Craig L. Stark]

TAKE ME TO YOUR LEADER

When creating a table of contents in WordPerfect, you have the option of displaying page numbers "Flush Right with leaders." "Leaders" are the row of dots that precede the page number. It would be useful to have this format for any right-aligned text, but WordPerfect's Flush Right command does not provide that option.

To work around this, I've created a batch file called CHLEAD.BAT, shown in Figure 1, which uses PC Magazine's CHANGE.COM program ("Quick-Change Artistry," Volume 5 Number 19) to change a string of bytes in a file globally. In a WordPerfect file, the standard "Flush Right" sequence consists of hex

ECHO OFF

```
REM This file will change a WordPerfect document with
REM "flush right" text starting with a pair of happy faces
REM (decimal 02) to one that has "flush right text with
REM leaders." If you want to use a different pair of marking
REM characters, replace the 02's in the command line with the
REM decimal ascii code of those characters.
REM
REM Note that this program will change your original file, so
REM make a backup in case the change doesn't work properly.
REM
REM The format is: "CHLEAD [filename]"
CHANGE %1 225,02,225,225,02,225,196,10 196,138
```

Figure 1: A batch file that adds leaders to selected Flush Right commands.

bytes C4 0A (decimal 196 10), while the sequence for "Flush Right with leaders" is hex C4 8A (decimal 196 138).

To avoid changing every "Flush Right" to "Flush Right with leaders," I mark the ones I want changed with a pair of happy-face characters (decimal 02, created by holding the Alt key down and pressing 2 on the numeric keypad). Then I save my file, make a backup copy, and run CHLEAD.BAT to change it. The next time I retrieve the file in WordPerfect, the happy faces are gone and in their place is a row of dots.

Note that you can type in the dots yourself in WordPerfect, but if you're working with proportionally spaced type, you won't get enough dots across the page to fill the blank space. Also, you'll get trouble if you type in the dots by hand and then change the margins.

Michael A. Cohen
Rockville, Maryland

I've often needed those dot leaders myself. My own method was to create and gener-

ate a fake List, with just a single item. I copied the "Flush Right with leaders" code from the resulting list and threw away the rest. Mr. Cohen's method is a lot cleaner if you don't mind getting out of WordPerfect to do it.

If you're familiar with DEBUG, you may be able to manage without CHANGE.COM. Search the file for the bytes

E1 2 E1 E1 2 C4 A

These are the same bytes shown in Figure 1, but expressed in hexadecimal. At each address found, change the final "A" to "8A". This will leave the happy-face characters in the file, but it's easy enough to remove them with WordPerfect.

EDITMAC

While WordPerfect Library contains a macro editor, I've hesitated to buy it just for that. Instead, I use ProKey (any similar keyboard macro utility should do) to edit and maintain WordPerfect macros. The technique should also work with other pro-

3D ENABLE

Every now and then in the software industry something momentous comes along and changes attitudes overnight. The introduction of Enable 2.0 (with a LAN version, and now available on 3½" disks) promises to be one of those events.



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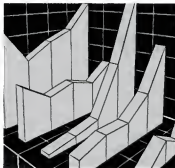
Now, Perspective is fully bundled in Enable 2.0. Which means you can now have an integrated system beyond all others. Word processing, spreadsheet, DBMS, communications and mind-boggling graphics all in one. All offering the power business users need (for confirmation, just read our "Raves" column to your right).

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Note: the six remarkable 3-D graphs you see on these two pages were drawn using Perspective. Which should give you greater perspective on Enable 2.0's vast potential.

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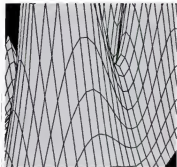
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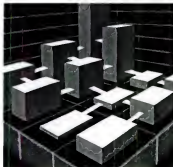
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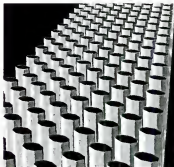
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grams besides *WordPerfect* that provide macro capability without giving you a convenient way to edit your macros.

1. Make sure *ProKey* is loaded before entering *WordPerfect*.

2. Hit Ctrl-F10 and name your macro, then put *ProKey* in keystroke recording mode. Be sure not to use an Alt-letter key for the *ProKey* macro, as these need to be reserved for *WordPerfect* macros.

3. End the *ProKey* recording mode, then hit Ctrl-F10 to end the WP macro definition.

4. Annotate the macro within *ProKey* to remind you later of its purpose.

To edit the macro, first determine what the keystrokes ought to have been. Edit the *ProKey* macro to produce the proper keystrokes. Now hit Ctrl-F10, name your macro, and play back the *ProKey* macro. Hit Ctrl-F10 again to end the definition and you're done.

Save the *ProKey* macros in a file, e.g., WORDPERF.MAC, so they can be recalled later. Not only can you now edit any of the saved macros without requiring the *WordPerfect Library*, you also have an annotated file describing them. Also, keeping a file of the *ProKey* macros allows you to save many occasionally used macros in a single file, thus saving disk space, avoiding naming conflicts, and cleaning up your directories.

Ivan Rezucha
Gardiner, New York

LCOLUMN

In *WordPerfect*, Version 4.1, text is displayed on the screen starting at the actual left margin. In Version 4.2, text is often shoved right up to the left edge of the screen. By creating the macro shown in the left column of Figure 2, you can reset the text on the screen so it displays as it did in Version 4.1.

You can execute the macro repeatedly from any point in the document. If left/right scrolling occurs, for example, the screen will reformat and revert to display-

ing your text against the left edge of the screen, so you just invoke the macro again.

Mitchell Smith
Orem, Utah

What you see is more clearly what you get when column 1 is at the far left of the screen. This looks especially good when the right margin is less than 80, of course.

Of special note is the "delay 0" statement at the start of this macro. Normally a WP macro executes invisibly behind a "Please Wait" message on the status line. However, this tricky reformatting macro will work only if every command in it happens visibly on the screen. Any Delay causes the screen to refresh after each command, and a Delay of zero does it without slowing execution.

The <Goto><Goto> command at the end restores the cursor to its position before the macro was executed. You can use

■ Using *ProKey*, you can edit any saved macros without requiring the *WordPerfect Library*.

that command any time to return to the location from which the lost "major motion command" was issued. For example, to jump to the top of the file and then return to wherever you were, you would use <Home><Home><Up> followed by <Ctrl-Home><Ctrl-Home>.

PAGINATING FOOTERS

WordPerfect currently lacks a method of automatically numbering pages in a footer in the form "(Page X of XX)", where XX is the total number of pages in the document. Such a numbering scheme is often necessary in contracts, descriptions, etc. A

```
<Ctrl-PgUp><Enter>
<Home><Home><Home><Left>
<Shift-F8><Enter><Enter>
<BackSpace>Y
<Ctrl-Home><Ctrl-Home>
```

Enter a delay of 0, so text, menus, and prompts will remain visible during macro execution
Go to extreme left on line
Set margin to 0, 00
Delete the margin you just set
Goto the last place a "major motion command" was given

Figure 2: A macro to restore displayed text to its true left margin.

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Glenn Hart, PC Magazine
May 12, 1987, Page 36.

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```

<Home><Home><Up>
<Alt>-F5<Enter>
<Alt>-F5<Enter>:x<F7>@

<Home><Home><Down>
<Alt>-F4
<Left><Alt>-F5<Enter>:i1
<Home><Home><Up>
<Alt>-F5<Enter>
<Down>
<Home><Home><Right>
<Left><Left><Left>
<Alt>-F4
<Right><Right>
<Ctrl>-F4<Enter>
<Home><Home><Up>
<Alt>-F4
<Down><Home>
<Home><Home><Home><Left>
<Del>-Y
<Del>
<Del>-Y
<Alt>-F5<Enter>
<Enter><Shift>-F6
<Ctrl>-F5<space><space>
<Ctrl>-F4<Enter>
<Home><Right><F7>@
<Alt>-F2<Alt>-F5<Enter>:x<F7>@

```

To top of document
Define table of contents, one level, right-justified page numbers
Create a dummy footer, so the page numbers will come out right.
To end of document
Block on
Mark for ToC, level 1
To top of document
Generate ToC
Arrow down one line
Go to extreme right of contents line
Arrow three spaces left
Block on
Block two characters right
Copy the page number
Back to top of document
Block on
Arrow two lines down
Go to extreme left of line
Delete entire ToC
Delete hard return
Delete dummy footer definition
Begin footer creation
Add space and center footer line
"B" = current page number
Recall page number
Finish footer line with "@"
Find and remove the ToC mark

Figure 3: Using WordPerfect's table-of-contents feature to create a page-numbering footer.

call to the company resulted only in a vague "We'll suggest it to our programmers." Until a new version includes this feature, however, the macro shown in Figure 3 will do the job.

In words, the series of commands in the macro does the following: It defines both a table of contents at the top of the document and a dummy footer that takes the same amount of space as the real footer will. At the bottom of the document, it places a ToC marker. Then it generates the table of contents and extracts the lone page reference from it. It deletes the ToC and the fake footer, then creates the real footer and inserts the saved last-page number into it. Finally it removes the fake ToC marker.

I do not feel that speed is seriously compromised when compared with having to re-create a footer manually, not to mention figuring out total document pages. I would, however, be interested in a faster, shorter macro that does the same job as the macro I've presented here if any of your readers can provide one.

Henry C. Gemhardt, Jr.
Huntington, West Virginia

This macro does assume that you don't have other tables or lists, and specifically that you don't have a table of contents. However, even if you do have a ToC already, you can use Mr. Gemhardt's macro with minor changes. Pick a List# you aren't using, say List# 5, and replace ref-

erences to ToC with List# 5. [Looking at Mr. Gemhardt's macro, I can't help but suggest that while WordPerfect is often lauded for its ease of use, sometimes a "command-driven" program such as XyWrite is both faster and simpler. In XyWrite III, the same footer would require

```

F5      (Go to the command line)
RP<Enter> (Begin footer)
<FC><Page><PN> of <FP>
F3      (Close footer)

```

FC, PN, and FP are two-letter mnemonics for the "Flush Center," "Page Number," and "Final Page" functions. The double angle brackets (visible only in "expanded" mode) are produced when you enter the function commands through a keystroke sequence such as F5, FC, F9.—Craig L. Stark]

REVERSE

In "Eight Ways to Improve WordPerfect" (PC Magazine, Volume 6 Number 7), Rhyder McClure describes a macro, ALT-R, that is designed to furnish printed output in the correct (reversed) order for laser printers. That macro required manual intervention to tell the number of pages in the document. It inspired me to design a fully automatic macro.

It turns out that two macros are necessary: the first, ALT-R, to go to the end of the file, and the second, REV, to do the printing. These are shown in Figure 4.

The technique I use is to go to the top of

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a page, print it, and then search backward for a space. If you are at the first page, this results in a "Not Found" message, which terminates the recursive macro.

Daniel L. Lieberman
Mercer Island, Washington

Macros exist to automate repetitive procedures for us. This one carries the automation one step further than its predecessor.

MACRO CALCULATIONS

With the macro shown in Figure 5, you can not only use WordPerfect's math capabilities to do a calculation, but insert the answer in your document, as well. If you need to drop in 6.25% of \$895, for example, you just hit <Alt-C> ".0625*895" <CR> and there it is! The macro can also handle far more complicated calculations, but it does require Version 4.2 (or later) of WordPerfect because it uses the pause function (<Ctrl-PgUp> <CR> <CR>) to permit user input during macro execution.

To use this macro you must understand the operators that WordPerfect allows: +, -, * (multiply), and / (divide). You may use parentheses to indicate precedence of operations, e.g., (6+.25)*895. Execute it any time you are not in "math mode" in your document.

To define the macro, begin by hitting Ctrl-F10 and naming the macro (I called mine Alt-C, for Calculate), then enter the keystrokes listed in Figure 5. The "<Ctrl-PgUp> <CR> <CR>" sequence instructs the macro to pause for input. You don't enter any formula during the macro definition, but the keystrokes that follow must work when you execute the macro and enter a real formula.

When you execute the macro, the screen will flash a bit and stop in the middle of the "Math Definition" menu. This is where you enter your calculation, followed by a carriage return. After more screen flashing you will end up with the result of your calculation inserted at the cursor in your document.

One problem occurs if you enter a character that is illegal in a formula, such as the letter O instead of zero. You will be left in the "Math Definition" screen and the "Tab Set" and "Math On" codes will be left in your document. To restore the docu-

```
<Ctrl-F10>      Begin macro definition
<Alt-R>         Name the macro Alt-R
<Home> <Home> <Down> Go to bottom of file
<Alt-F10>       Invoke a macro
REV<Enter>      Macro to be invoked is REV
<Ctrl-F10>      End macro definition
```

To create the REV macro, use the following keystrokes:

```
<Ctrl-F10>      Begin macro definition
REV<Enter>      Name the macro REV
<Ctrl-Home> <Up> Go to top of current page
<Shift-F7> 2    Print current page
<Shift-F2>     Reverse search
<Space> <Esc> Search for a space. NOTE: Macro terminates
               here when it reaches the first page
<Alt-F10>       Invoke a macro
REV<Enter>      Macro to be invoked is REV itself
<Ctrl-F10>      End macro definition
```

Figure 4: The keystrokes to create the two macros for printing out in the correct page order on nonreversing laser printers.

```
<CR> <CR> <Left-arrow>      Make room for work in the document
<Shift-F8> 1 <Space> <Tab> <F7> Set a tab stop, to be sure there is one. A
                                   math calculation column
                                   requires a tab.
<Alt-F7> 28                  Begin Math Definition
<Ctrl-PgUp> <CR> <CR>      Pause to allow entry of the formula
                                   during macro execution
                                   End Math Definition, turn Math on
<F7> 1                        Calculate
<Tab> <Alt-F7> 2             Block on
                                   Reverse search for [HRT]
<Alt-F4>                     Delete the block
<Shift-F2> <CR> <F2>        Delete the remaining things we
                                   added
<Del> Y                       Delete the remaining things we
                                   added
<Bksc> <End> <Del> <Bksc>   End the macro definition
<Ctrl-F10>
```

Figure 5: The keystrokes to produce a WordPerfect macro for calculating and inserting answers into a document.

ment to its original condition, hit F7 and Exit twice to get back to the document screen, backspace three times, and hit the Del key once.

Kenneth R. Kletzien
New York, New York

This tricky macro will indeed perform complicated calculations for you. The result will have two digits to the right of the decimal. To change the number of digits, you can modify the macro as follows:

After the pause statement that takes your formula, insert the lines

```
<Down> <Down> <Left>
<Ctrl-PgUp> <CR> <CR>
```

The first line moves to the "# of digits" position, and the second pauses for input.

You may want to save the modified macro as CDIG, to indicate that it allows you to set the number of digits. After you enter a formula in CDIG, you can specify 0 to 4 digits to the right of the decimal point.

SCROLLING ALONG

The only WordStar feature I miss in WordPerfect is the continuous or autoscroll function. With the large, clear WordPerfect screen, the cursor movements to top and bottom of screen are adequate for short documents. But for longer documents, I'm spoiled by being able to watch my cunningly contrived words scroll smoothly up the screen.

The macro shown in Figure 6, while it could hardly be called elegant, avoids the complication of a looping macro, namely, that the filename flashes maddeningly at the bottom left of the screen. Before creating the macro, you must decide the maximum length of the documents you wish to scroll through without halting. Twenty or 30 pages should be more than adequate for most uses.

Now, when you want to scroll through a document, move to the point where you want to begin and hit Alt-F10. When the word "Macro" appears, type DOWN and

press Enter. The cursor will move to the bottom of the screen and the text will begin to scroll upward. When you want to stop scrolling, simply press the F1 key. This takes a moment to stop the scrolling—do not press it a second time.

Obviously, 20 pages of DOWN aren't needed if you don't expect to scroll documents of more than a few pages. But even my macro with 20 pages of DOWN commands takes only about 500 bytes, and it doesn't take over 2 minutes to create.

Hayford Peirce
Tahiti, French Polynesia

For some reason I had trouble stopping this macro. The usual <F1> didn't seem to work. I found the recursive macro to be

■ With WordPerfect's conditional chaining, any macro can transfer control to another macro.

easier to create and use, despite the flashing in the lower left corner. It goes as follows:

```
<Ctrl-F10>      Begin macro def.
DOWNREC<CR>    Call it DOWNREC
<Ctrl-PgUp>0<CR> Make macro visible
<Down>         Down one line
<Alt-F10>      Invoke a macro
DOWNREC<CR>    ... DOWNREC itself
<Ctrl-F10>      End definition
```

Another alternative to typing thousands of Down Arrows is to build the macro from smaller pieces. For example, the macro DOWNPAGE might contain 50 Down Arrows. Then the main DOWN macro need only invoke DOWNPAGE 20 times to have the equivalent of 1,000 Down-Arrow keypresses.

LIST INSERTION

WordPerfect's file manager can put an ordered list of your files on the screen, but what if you want to put the list into a text file? As it turns out, you can do so. If you hit F5 to reach the file manager and then press Shift-F7, you will print the list of files. By directing print output to a file, you can capture the list for further manipula-

```
<Ctrl-F10>      Begin macro definition
DOWN<Enter>     Enter the name and a Carriage Return
<Home><Down>    Start at the bottom of the current screen
<Ctrl-PgUp>25<Enter> Put a 2.5 second pause between each line scrolling up the screen
<Down><Down>    Press the <Down> arrow as many times as you think you will need it -- no matter that the cursor doesn't actually move.
<Ctrl-F10>      End macro definition
```

Figure 6: An autoscroll macro for WordPerfect.

```
FILELIST.MAC
<Shift-F7>411000      Select printer 0
<F5><Enter><Shift-F7> Bring up the file list and print it
<Ctrl-PgUp>50<Enter> Insert a delay of 5 seconds to be sure the directory is done printing
                        End the delay
<Ctrl-PgUp>255<Enter> Retrieve the file containing the list.
<Ctrl-F5>2DOS.TXT<Enter> Call the macro SPLIT
<Alt-F10>SPLIT

SPLIT.MAC
<Alt-F10>MORELIST      Call the macro MORELIST -- this only happens after SPLIT has failed its search
<F2>|<Esc>             Search for a "|" character
<BackSpace><Enter>     Delete the "|" and break the line
<Alt-F10>SPLIT          Call SPLIT again

MORELIST.MAC
<Home><Home><Up>        Go to the top of the document
<F2>CURRENT<Esc>      Find the word "CURRENT"
<Home><Left>           Go to the beginning of the line
<Ctrl><End><Del>        Erase the line
<Ctrl><End><Del>        Erase the next line too
<Shift><F7>411100      Select printer 1 again
```

Figure 7: A multiple macro that lets you insert an ordered list of files into a document.

tion. The set of three macros shown in Figure 7 assumes several things. First, it assumes that you have defined printer number 6 as a file named DOS.TXT. Second, it assumes your default printer is number 1. Third, it assumes you begin with an empty document. And fourth, it assumes you are not currently printing something in the background.

The SPLIT macro uses WordPerfect's conditional chaining. Any macro can transfer control to another macro when it ends. If a macro contains a search, you can choose one of two macros based on the result of the search. You put a call to the macro to be executed when the search fails at the very top of the conditional macro. In this case, that's MORELIST. The macro to be executed when the search succeeds goes at the end of the conditional macro. Here that's another call to SPLIT. Thus, as long as SPLIT can find another "|" character, it keeps calling itself. When it finishes, it calls MORELIST to clean up the result.

MORELIST finds the line in the output that contains the word CURRENT and deletes it. It also deletes the next line, the one

that contains the entry for PARENT. These two entries don't contain any useful information. Finally, MORELIST makes printer number 1 the default again.

After this macro set finishes, you will have on your screen a single-column listing of the current directory. You can annotate the file names, sort the directory (using WP's sort facility), or do whatever you wish.

HELPSCRN

I have developed a complete macro help system for WordPerfect. It depends on some of the special merge commands to display a help screen and let the user choose the next macro. In the example help system shown here, all the macros simply display more help. However, you could easily extend the method so that the user could pick a macro from a help menu and have that macro run.

I tied the initial help macro to the Alt-H key. Create it as follows:

```
<Ctrl-F10>      Begin macro definition
<Alt-H>         Name the macro Alt-H
<Ctrl-F5>       Select merge
HELP.MRG<Enter> Specify pr1, merge file
<Enter>         Specify no sec. merge file
<Ctrl-F10>      End macro definition
```

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• Draw 3,200 Vertical Lines	9.381	4.949
• Draw 20,000 Horizontal Lines	15.766	5.551
• Fill 200 Circles	7.669	5.431
Math:		
• Integer Math	4.284	4.230
• Floating Point, Single Precision	8.184	1.825
• Sines and Cosines (7,200)	15.589	4.687
• Single Precision Exp	13.731	3.742
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• Borland's Test	0.714	0.055
• Microsoft's Test	54.326	4.781
• Bubble Sort (1,000 Integers)	2.856	2.477
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• Random (2,000)	52.234	51.078
Text I/O:		
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• Screen Mode 2 (5,000 characters)	4.339	4.070

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^O		

: Pop Up Window : MACRO HELP (Alt-H) Page 1 of 3 : 1/21/87 Ver. 1.00 :		

: - Key -	: Name	: Description
: Alt-A	: print All	: Print the entire Document
: Alt-B	:	: ** Not Used **
: Alt-C	: spell Check	: Starts the Spell Checker for the entire Document
: Alt-D	: Date	: Inserts the current date
: Alt-E	:	: ** Not Used **
: Alt-F	: Font select	: Displays the Pop Up Window for Font Selection
: Alt-G	:	: ** Not Used **
: Alt-H	: Help	: Displays this Pop Up Window
:	:	:
: F9 - Quit	: 2 - Page #2 (I-P)	: 3 - Page #3 (Q-Z)

Enter Number of Selection followed by F9 ^O^CHelp^O^Q		

Figure 8: A sample merge file for help with WordPerfect macros.

<Ctrl-F10>	Define macro
<Alt-M>	M for Memo
<Ctrl-PgUp>@<Enter>	Make macro execution visible
<Shift-F3>	Switch to other document
DATE:<Tab><Shift-F8>1<CR>	Insert the current date
RE:<F4>	Text "RE:" plus indent
<Ctrl-PgUp><CR><CR><CR>	Accept user input here. Note that <CR> stands for Carriage Return and is the same as <Enter>.
MESSAGE:<CR>	Accept the message text
<Ctrl-PgUp><CR><CR><CR>	Add a couple of blank lines
<CR><CR>	Block On
<Alt-F4>	Go to top
<Home><Home><Up>	Append block to file "MEMOS"
<Ctrl-F4>3MEMOS<CR>	Exit Doc 2 w/o saving file
<F7>NY	End macro definition
<Ctrl-F10>	

Figure 9: A handy macro for making informal notes.

The merge document in Figure 8 uses the ^O (Ctrl-O) command to display a message, the ^C command to get user input, the ^G command to execute a macro, and the ^Q command to quit the merge. Note that the pair of ^O commands surrounds the entire file except for the final ^Q. Be careful not to put any characters outside the ^Os, as they will be inserted into your document. The pair of ^G commands tells WordPerfect to execute the macro they surround when the merge ends. The ^C command just before the word "HELP" allows user input. Since the ^C is between the ^Gs, whatever the user types modifies the name of the next macro. For example, if you type 2 and hit F9, the next macro will be "2HELP".

If the operator hits F9 without making any selection, WP tries to execute the macro HELP. To avoid an error message when it doesn't find that macro, I created HELP.MAC as follows:

```
<Ctrl-F10>      Begin macro definition
HELP<Enter>     Call it HELP
<Ctrl-F10>      Rewrite the screen
<Ctrl-F10>      End macro definition
```

The numbered macros 1HELP, 2HELP, and 3HELP are all identical to ALTH.MAC (the six-line macro above), except that each invokes the same-numbered merge document. [I did not include HELP1.MRG and HELP3.MRG, as they are simply examples. You can create them by copying HELP1.MRG and modifying the copies as you please.—Ed.]

You can also let the user choose Alt-key macros directly from the menu. Just create a file of the form ?HELP.MAC for each ALT?MAC. For example, to let the user run ALTA.MAC from the menu, create AHHELP.MAC as follows:

```
<Ctrl-F10>      Begin macro definition
AHHELP<Enter>   Call it AHHELP
<Alt-A>         From Alt-A
<Ctrl-F10>      End macro definition
```

With this combination of macros and merge documents, you can create a complete menu system that allows the operator to use all of your macros without having to memorize them.

Mark E. Cohen
Cornish, New Hampshire

This is certainly a novel use for the ^O merge command. The help screens don't pop up; rather, they slide up elegantly from the bottom of the screen. I've seen quite a few proposed methods for giving the user help with macros, but this one is by far the best. If you decide to let the user choose Alt-key macros directly from the menu, note that you can call such a macro by its full name. That is, rather than press Alt-H, you could invoke it by the name "ALTH". You could change the end of the merge document to "GALT C G O Q". That will save you the trouble of creating a ?HELP.MAC for every Alt-key macro.

MEMOMAKER

I use the Alt-M (for MESSAGE) macro shown in Figure 9 when I'm taking dictation and the boss gives instructions that are not part of the correspondence or report. It's also handy when I answer the phone without a notepad at hand. And I use it when an idea crosses my mind while I'm inputting and I want to record it quickly without too much interruption of my work. I hope others find it equally helpful.

Glenda Hannon Luke
Seattle, Washington

The author's original form required you to keep Doc 2 free for memos at all times. I modified it to Block Append each memo to a growing file called MEMOS. Now Doc 2 needs to be free only at the time you use Alt-M. The modified macro shown in Figure 9 does require that the file MEMOS exist, because you can't Append to something that's not there.

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Neil J. Rubenking is a contributing editor of PC Magazine and is an avid Word Perfect user. Craig L. Stark is senior editor for technical columns of PC Magazine.

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■ LANGUAGES

HANDLING RUN-TIME ERRORS

The IOResult function in Turbo Pascal allows you to manage I/O errors nicely, but there is little help for recovery from other errors. Turbo, Version 3.01A, includes information about user-written error handlers that are usually used only to make the exit smoother. If the user does not HALT the program, the regular error routine will force termination.

I enclose a way to manage run-time errors without exiting the program. I have tested this method in Turbo 3.01A, with and without 8087 support. For other versions that support error handlers, it would be necessary to locate the address of the error number (DSEg:\$188 in 3.01A and 3.02A) and use this address in the ErrorTrap procedure.

Because of the nature of the INLINE code, the variables ErrorExitAddress and OldStackPointer must be declared globally. The procedure OnErrorComeHere must be invoked at the point where we

want to return after the error. If it appears more than once, the most recent invocation is active.

The error type, number, and address are available through the values of ErrNo and ErrAddr, exactly as in the ordinary error handlers. The example program in Figure 2 illustrates the three main exit possibilities: (1) a Ctrl-C (or Ctrl-Break) will terminate by using HALT; (2) a division by zero, or a numeric format error, will display a message and continue execution; or (3) any other run-time error will crash via the normal Turbo error handler. To see these different possibilities, answer the request for X and Y values with (1) Ctrl-C, (2) nonnumeric input or 1 and 0, or (3) 1E20 and 1E-20 (1E300 and 1E-300 if you are using the 8087 version).

The main limitation of the method is that to resume execution, the error return address must be on the stack. To guarantee that, the error must occur after the OnErrorComeHere procedure and in the same

```
PROGRAM ErrorTrap_Demo;
($U+)
VAR
  ErrorExitAddress, OldStackPointer : Integer;
  X, Y                               : Real;

PROCEDURE ErrorTrap(ErrNo, ErrAddr : Integer);
BEGIN
  CASE ErrNo OF
    $0001 : BEGIN Writeln('***User Break'); Halt; END;
    $0110 : Writeln(' Error in numeric format. ');
    $0202 : Writeln(' Division by zero. ');
  ELSE Exit;
  END; {case}
  CBreak := True; { Reset Ctrl-Break check flag }
  Memw[DSEg:$188] := 0; { Reset error condition flag }
  INLINE($EB/$26/OldStackPointer/ { MOV SP, OldStackPointer }
    $FF/$26/ErrorExitAddress); { JMP ErrorExitAddress }
END;

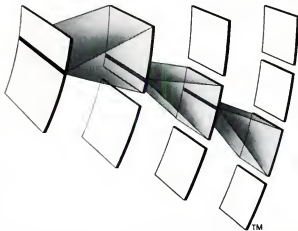
PROCEDURE OnErrorComeHere;
BEGIN
  INLINE(
    $D/ { POP BP }
    $B/ { POP BX }
    $E/ { POP AX }
    $A2/ErrorExitAddress/ { MOV ErrorExitAddress, AX }
    $B/$26/OldStackPointer/ { MOV OldStackPointer, SP }
    $E/ { PUSH AX }
    $C/ { PUSH BX }
    $B; { PUSH BP }
  )
END;

BEGIN
  ErrorPtr := Ofc(ErrorTrap); { Enable the error handler }
  REPEAT
    OnErrorComeHere;
    Write('Enter X,Y: ');
    Readln(X, Y);
    Writeln(X, ' / ', Y, ' = ', X/Y);
  UNTIL False;
END.
```

Figure 2: A method of trapping run-time errors.

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Christopher O'Malley
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■ LANGUAGES

block, or in a procedure or function called (directly or indirectly) at such a location.

I have used this method to write a complex program where plenty of arithmetic errors can occur in very different conditions and in such a way that it is very difficult to anticipate them. With this method, I can wait for an error to occur and handle it on the spot. This makes life a lot easier.

Juan M. Aguirregabiria
Bilbao, Spain

The ErrNo variable in the ErrorTrap procedure contains the type of error in its high byte and the exact error number in its low byte. The three types of error are User Break (0), I/O Error (1), and Run-Time Error (2). Thus, for example, an ErrNo value of \$0290 would indicate Run-Time Error number 90, index out of range.

—Neil J. Rubenking

TRAPPING I/O ERRORS

One nice attribute of Turbo Pascal is its ability to trap fatal I/O errors through the \$I compiler directive. It would be convenient to have a similar method for trapping floating-point errors without crashing the program. Such a feature would involve considerable modification of the run-time library, but simply ignoring the errors is still useful and much easier to do. The program in Figure 3 contains two procedures: Trapoff and Trapon, which modify and restore the run-time library to selectively ignore floating-point errors. The Trapoff procedure disables checking for floating-point overflow and Sqrt and Ln argument errors. Trapon restores the library to its original condition and should be called before exiting a program that uses Trapoff. The demonstration program illustrates the use of the procedures. Note that after you call Trapoff, there is no indication of a floating-point error. It is up to the user to interpret the validity of any floating-point results. In many situations this is preferable to dumping the program. (I have tested these procedures with Turbo, Version 3.01A.)

David Markovitch
Madison, Wisconsin

A program that self-patches the run-time library will usually only work under one specific version of Turbo Pascal. If you are

```
PROGRAM traptest;
VAR dummy : Char;

PROCEDURE trapoff;
BEGIN
  MemW[CSeg:$1B83] := $0000; {Floating point overflow}
  MemW[CSeg:$1C5C] := $0000; {Ln argument error}
  MemW[CSeg:$1C61] := $05EB;
  MemW[CSeg:$1B8E] := $E680; {Sqrt argument error}
  MemW[CSeg:$1B60] := $7F;
  MemW[CSeg:$1B61] := $0000;
  WriteLn('Floating point error trapping is OFF');
END;

PROCEDURE trapon;
BEGIN
  MemW[CSeg:$1B83] := $0772; {Floating point overflow}
  MemW[CSeg:$1C5C] := $0574; {Ln argument error}
  MemW[CSeg:$1C61] := $0574;
  MemW[CSeg:$1B8E] := $C6F0; {Sqrt argument error}
  MemW[CSeg:$1B60] := $80;
  MemW[CSeg:$1B61] := $437B;
  WriteLn('Floating point error trapping is ON');
END;

BEGIN
  IF MemW[CSeg:$101] <> $2C79 THEN
    BEGIN WriteLn('#7, You need Turbo version 3.01A!'); Halt; END;
  ClrScr;
  trapoff;
  WriteLn('R = ', 1e20, '          R*R = ', 1e20*1e20);
  WriteLn('R = ', 0.0, '          Ln(R) = ', Ln(0.0));
  WriteLn('R = ', -49.0, '        Sqrt(R) = ', Sqrt(-49.0));
  WriteLn; WriteLn('Hit any key');
  Read(Kbd, dummy);
  trapon;
  WriteLn;
  WriteLn('R = ', -49.0, '          Sqrt(R) = ', Sqrt(-49.0));
END.
```

Figure 3: The Traptest program demonstrates how to disable some of Turbo's error trapping.

version	value	version	value
1.00A	\$222C	3.01A	\$2C78
2.00B	\$2725	3.01A w/ 8087	\$272C
2.00B w/ 8087	\$22FA	3.01A w/ BCD	\$2B87
3.00B	\$2BB3	3.02A	\$2C4A
3.00B w/ 8087	\$2666	3.02A w/ 8087	\$26FD
3.00B w/ BCD	\$2AC1	3.02A w/ BCD	\$2B5A

Figure 4: Values found at MEMW[CSeg:\$101] for different versions of Turbo Pascal.

just distributing the compiled program, this is not a problem. You know which version of the compiler you are using. However, if you distribute the source code, you may want to include a check for the correct version. A compiled Turbo program does not specifically include the version number, but it always begins with a JMP past the run-time library. The value of this jump has been different for every version of Turbo Pascal, so I use it to test for the correct version. Figure 4 is a list of the integer values found at location CSeg:\$101 for all versions of Turbo Pascal.

—Neil J. Rubenking

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CIRCLE 717 ON READER SERVICE CARD

■ ROBERT L. HUMMEL AND CHARLES PETZOLD

PC TUTOR



Switching speeds on a turbo XT motherboard; converting tabs into four spaces for easier program printouts; understanding how different editors respond to end-of-file markers.

SPEED SWAPPING

In response to Lt. Stallings's problem (PC Tutor, Volume 6 Number 10) in switching speeds on his turbo XT motherboard, I have enclosed two programs. FAST.COM will switch the computer to turbo mode, and SLOW.COM will restore the speed to 4.77 MHz.

Amin R. Ismail
Dayton, Ohio

Since turbo XT makers often clone each other as well as the IBM original, the SWITCHSP.COM program shown here should toggle the speed on most turbo XT motherboards.

Jon Radel
Leesburg, Virginia

The reader response was overwhelming on this question, and it provides proof of the technical prowess of PC Magazine readers. To create the three files, load DEBUG, then type the following commands:

```

RDX
T
M FAST.COM
A 109
IN AL,61
OR AL,4
OUT 61,AL
RDT

M
N SLOW.COM
A 192
AND AL,FB

M
N SWITCHSP.COM
A 192
XOR AL,4

W
Q

```

Be sure to include the blank lines (just hit the Enter key an extra time) before the W in three places to exit DEBUG's assemble mode. This will create three 7-byte files.—Robert L. Hummel

CHANGING THE TAB WIDTH

The DOS TYPE and PRINT commands expand tab characters to every eighth character position. This is fine for letters, but when used in program source code, eight spaces per tab makes the listing too wide. I would like to change the tabs to every fourth position. This is no problem with my editor, but is there any way to change TYPE and PRINT?

Richard Morgan
Tulsa, Oklahoma

Although PRINT is certainly guilty of expanding tabs, the TYPE and the COPY commands do not directly do so. When you use TYPE and COPY on the screen, the tabs are expanded because the standard output device in DOS expands the tabs. You can get some sense of this if you use

```
COPY /B filename CON
```

where filename is the name of a file containing tab characters. The tab characters will show up on the screen as little round circles because you're doing the COPY in binary mode.

When you enter either

```
TYPE filename >PRN
```

or

```
COPY filename PRN
```

the commands send the file directly to the printer. The printer itself then expands the tabs. Many printers allow you to set horizontal tabs with control sequences. For instance, the IBM Graphics Printer uses the control sequence ESC-D followed by the new tab positions. You can use that approach if you want different tab stops from TYPE and COPY.

But for general-purpose use, I think what you really want is a program that converts a file containing tabs to a file without tabs, where the tabs have been expanded into spaces.

The TAB4 program in Figure 1 does this. You can create TAB4.COM by loading DEBUG and entering the lines shown. You do not need to type the semicolons or the comments that follow them. Alternatively, you can type the lines into a file called TAB4.SCR and create TAB4.COM by executing

```
DEBUG <TAB4.SCR
```

TAB4 uses redirection of standard input and output. If you want to send a file out to the printer with tabs at every fourth character, use

```
TAB4 < filename > PRN
```

To prepare a file for PRINT, use

```
TAB4 < filename1 > filename2
```

where filename1 is your original file (with

■ PC TUTOR

```

N TAB4.COM
A
MOV     DI,0000      ; Chars per line
MOV     BX,0000      ; NEXTBLOCK: Input handle
MOV     CX,0080      ; Number of chars
MOV     DX,0080      ; Default buffer area
MOV     AH,3F        ; Read 128 bytes
INT     21
MOV     CX,AX        ; Number read
JCXZ    0143         ; If 0, jmp to ENDPROG
MOV     SI,DX        ; Source of chars
LODSB   ; NEXTCHAR: Get a char
CMP     AL,09        ; See if tab
JNZ     0130         ; If not, jmp NOTTAB
PUSH    CX           ; Save CX
MOV     CX,0003      ; Set CX to 3
SUB     CX,DI        ; Subtract char counter
AND     CX,0003      ; AND with 3
INC     CX           ; Increment
MOV     AL,20        ; TABLOOP:
CALL    0145         ; Call OUTPUT
LOOP    0126         ; Loop to TABLOOP:
POP     CX
JMP     013F         ; Jump to ENDCHAR:
CMP     AL,0A        ; NOTTAB: see if Line feed
JZ      0138         ; if so, jump NEWLINE:
CMP     AL,0D        ; check if carriage return
JNZ     013B         ; if not, jump NORMAL:
MOV     DI,FFFF      ; NEWLINE: Set DI to -1
INC     DI           ; NORMAL: increment counter
CALL    0145         ; Call OUTPUT
LOOP    0116         ; ENDCHAR: Loop to NEXTCHAR:
JMP     0103         ; Jump to NEXTBLOCK:
INT     20           ; ENDPROG:
MOV     DL,AL        ; OUTPUT:
MOV     AH,06
INT     21
RET

R CX
4C
W
Q

```

Figure 1: This TAB4 program uses redirection of input and output to convert a file containing tab characters to a file where the tabs have been expanded to spaces at every fourth character position.

the tabs) and filename2 is a new file that you'll use with PRINT. Do not use the same names for filename1 and filename2! If you want to change the file permanently in one step, you can do it with the following command:

TYPE filename : TAB4 > filename

Use TAB4 only with ASCII text files that do not contain imbedded formatting information.—Charles Petzold

THE END-OF-FILE MARKER

I think I've discovered a bug of sorts in some recent versions of DOS. It shows up when I use the >> redirection symbol to

add data to the end of a text file. If I execute the commands

```

ECHO Line 1 >>TEST.TXT
ECHO Line 2 >>TEST.TXT
ECHO Line 3 >>TEST.TXT

```

and run

TYPE TEST.TXT

I get

```

Line 1
Line 2
Line 3

```

Good enough. But if I now load this same file into EDLIN, save it with the E command, and append another line to it, thus:

ECHO Line 4 >>TEST.TXT

and do another TYPE command, I get the same three lines I had before!

What happened to the line I appended after editing the file with EDLIN? This doesn't happen just with EDLIN, but with a variety of other text editors. What's going on?

Mark E. Hoffman
Atkinson, New Hampshire

It's not a bug. It's just a different way that different programs and commands use the end-of-file marker.

The ASCII character Ctrl-Z, code 26 (1Ah in hexadecimal) means "end-of-file." It's generally the last character in files created by traditional text editors.

Programs written for DOS should not (in theory) require the end-of-file marker since the exact size of the file is contained in the directory entry. This was not always the case. For instance, DOS's predecessor in the 8-bit microcomputer world was CP/M. CP/M always stored files in blocks of 128 bytes. The CP/M directory entries indicated only the number of 128-byte blocks and not the exact size of the file. ASCII text editors needed the end-of-file marker to determine what was actually part of the file and what was junk.

When you redirect standard output to a file, the end-of-file marker is not used. DOS does not append an end-of-file marker to the file it writes. If the file already

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contains one, DOS does not remove it.

However, EDLIN always adds an end-of-file marker to files it saves. This makes its files compatible with those of traditional text editors. For instance, WordStar

3.31—which in many ways still believes it's running under CP/M—will display some Ctrl-G (NULL) characters at the end of a file if it does not find an end-of-file marker. I've also experienced some Word-

Star crashes while working with files without end-of-file markers.

The TYPE command always stops at the first end-of-file marker it finds. In your example, EDLIN added on end-of-file marker to the file, and the next redirection command appended the line after that end-of-file marker. But the line is still in the file. For instance, you might load the file into EDLIN in binary mode, thus:

```
EDLIN TEST.TXT /B
```

This directs EDLIN to load in the entire file without regard to imbedded end-of-file markers. You'll see the whole file, including your "missing" fourth line, if you do on L (list) in EDLIN. You can also see the whole file if you execute

```
COPY /B TEST.TXT CON
```

This does a "binary mode" copy of the file to CON (the screen console). The end-of-file markers show up as little right arrows.

But even if you use EDLIN in binary mode, it will still append an end-of-file marker to the end of the file. The problem is getting rid of it. Here's one solution. After you exit from EDLIN, execute

```
TYPE TEST.TXT >TEMP.TMP
DEL TEST.TXT
REN TEMP.TMP TEST.TXT
```

The TYPE command normally displays the file TEST.TXT up to (but not including) the end-of-file marker. Since we're redirecting output to a file, that data goes into TEMP.TMP. Now just delete the original TEST.TXT file and rename TEMP.TMP to TEST.TXT. The resulting file does not have a terminating end-of-file marker. —Charles Petzold

ASK THE TUTOR

The PC Tutor solves practical problems and explains points of general interest. To see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016.

Robert L. Hummel is senior technical editor on the staff of PC Magazine. Charles Petzold is a contributing editor of PC Magazine.

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■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC



How to tie far-flung PCs together, maximizing network performance with the right hard disk, and making a PC act like a System/36.

PC MAGAZINE'S IRS

I am currently working on a project involving approximately 20 standalone PCs in widely separated locations. We want to link them together through a private bulletin board system and we need something exactly like your PC Magazine Interactive Reader Service. Please elaborate on the hardware setup of PC-IRS. I am particularly intrigued by the multiple AT and rack-mounted modem setup, as well as by what OS this system uses.

Jeffrey Loo
Honolulu, Hawaii

Chris Barr, the manager of the Interactive Reader Service, tells us that PC-IRS uses standard MS-DOS and Chairman software, a multiuser program from DMA (New York, N.Y.; (212) 687-7115). Chairman allows up to six simultaneous users per computer. We have four AT-type computers, each equipped with a multiport board from Arnet (Nashville, Tenn.; (615) 254-0646). Chairman uses ports 3-8 on the Arnet boards. These ports are connected to rack-mounted Hayes or Multitech 2,400-bit-per-second modems. The Multitech modems tested well in PC Labs, and rack mounting avoids heat problems. This system supports an average of 60 log-ons per line each day with the average on-line time being 22 minutes.

An alternative is RAMNet, an interesting blend of bulletin board, RS-232 LAN, and FIDO-like communications network. It permits inter-PC file transfers, networking, and electronic mail in background. It requires no additional hardware beyond a

modem. RAMNet is available from Software Concepts Designs (New York, N.Y.; (212) 889-6431).

FAST SERVER STORAGE

You have written that the hard disk drive in the server is the slowest part of the network. If I want maximum performance from my network, what kind of hard disk drive should I install in the IBM PC AT that I will use as the server?

E. Horton
Arlington, Virginia

For absolute speed, you could use the solid-state BatRAM from Santa Clara Systems or Dart from Newer Technology, of Wichita, Kansas, as an alternative to an electromechanical drive. However, assuming you don't want to pay the price for solid-state storage, the fastest electromechanical drive currently available is the HC40, with a 10-millisecond access time,

from Core International. If you need higher capacities, Core offers a line of network drives from 82 to 1,000 megabytes (four 260-meg drives) with access times ranging from 15 to 16 milliseconds. But wait! An important factor in network throughput can be the hard disk drive controller technology. The fastest controllers currently transfer data at 10 MHz using a technique called ESDI. In comparison, the controller in the IBM PC AT transfers data at 5 MHz. But this doesn't mean that the performance benefit of the ESDI is merely 2 to 1. The ESDI system is much more efficient, and the measured throughput of the ESDI controller is over 900,000 bits per second versus 165,000 bps for the standard AT controller. The ESDI controller also allows you to format your drive at a 1:1 interleave for better efficiency.

Fox Research, the maker of 10-NET, released a technical note to its dealers recommending the use of ESDI controllers. Fox states that an ESDI controller can give throughput up to 60 percent faster than the standard hard disk drives used in the Compaq 386. For more information, see "Hard Disk Heavyweights" in Volume 6 Number 11.

■ The fastest controllers transfer data at 10 MHz using a technique called ESDI, whereas the controller in the IBM PC AT transfers data at 5 MHz.

REPLACING A MINI—REVISITED

A reader recently asked about replacing an accounting application on an IBM System/34 with a LAN, and you replied that you didn't know of a good way of doing it. You also invited vendors to prove you wrong.

If the System/34 applications are written in RPG II (as most of them are), they

■ CONNECTIVITY CLINIC

can be quickly converted to run on a microcomputer-based LAN using *BABY/36* software systems from California Software Products Inc. (Santa Ana, Calif.; (714) 973-0440).

BABY/36 software emulates the operating system of the IBM System/36 mini-computer, permitting development and execution of System/34 and System/36 applications on the PC after they go

through an automated conversion process.

Over the past 3 years, more than 14,000 PCs have started thinking they are mini-computers because of *BABY/36*.

Mark Tonnesson
Santa Ana, California

Every bit of your time counts! Save your time with **XD-SHELL™**

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XD-SHELL
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XD-SHELL is a memory resident program which provides the user the following capabilities while running an application:

- Directly from a scrollable directory display, you can view files, copy files, erase files, change the default directory, and, when not in application, execute programs.
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CIRCLE 399 ON READER SERVICE CARD

We don't have any experience with this solution, but it is surely worth investigating. Other companies marketing DBMS products for LANs wrote to say that their DBMS could be used to write an application to replace the one on the System/34. But only one company, DataAccess, named an existing application. According to them, *The Software Works* (Los Angeles Calif.; (818) 500-1806) has a successful LAN-based multiuser accounting system written in the DataFlex DBMS.

REPLACING A MINI—RE-REVISITED

The biotechnology corporation I work for is investigating solutions for managing inventory and ordering for manufacturing purposes. We have an ARCnet/NetWare 286 network in place. However, we have been unable to locate software that will do what ASK ManMan will do on a VAX system. An area of special concern is backward lot tracking. A plus would be highly summarized reports for upper management. Do you know of any such software for PC-based networks?

Richard Adams
Hana Biologics Inc.
Alameda, California

Mr. Adams, I don't know of any off-the-shelf programs ready to meet your needs. Vendors, how about you? The markets for LAN-based multiuser personnel, inventory, purchasing, reservation, and accounting programs are wide open. The tools (Paradox, DataEase, DataAccess, PC-Focus, Open Access II, Smart, Enable, R:Base System V, and others) needed to create the end-user applications are available. Who will pick them up and use them?

IBM'S TYPUS

I purchased the IBM 2,400-bps external modem model 5842 because it supports synchronous operation. The description on the box and in some advertising says that auto-dialing is not supported in synchronous mode. This is not correct. Auto-dial-

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CIRCLE 362 ON READER SERVICE CARD



The DATASHOW System is designed for real-time presentation with IBM PC or 100% compatible computers. Remote control and software (included) provide a variety of presentation conveniences and enhancements. With optional plug-in DATASHOW Composite Video Adapter, the system may also be used with Apple II computers. (Remote control and software do not operate in this mode.) Another unit, the DATASHOW Projection Pad for only \$1095,* projects real-time PC images, but does not include remote control or software.

*Prices shown are Kodak's suggested prices only. Actual selling prices are determined by dealer.



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H.P. Meles
Zurich, Switzerland

Thank you, and thanks also to our many other European contributors.

FILE-TRANSFER CONFLICT

I just bought a pair of Microcom error-correcting modems to get rid of the telephone noise we were experiencing. Everything seems to be working OK—we don't get any more garbage on the screen—except that file transfer no longer works. What's the problem?

J. Feldstein
Panama City, Florida

Intelligent modems respond to a special character string in the data stream causing them to go into their command mode. File transfer protocols such as Xmodem, Kermit, or others may coincidentally send this special character during file transfer. This will cause the modem to stop sending data and look for commands. The default for Microcom AX1200 and AX2400 modems is Ctrl-A (decimal 1). You can alter this default either by switching to Hayes-compatible mode or by issuing the command SED to disable this feature.

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CIRCLE 296 ON READER SERVICE CARD



I'M CLOSER THAN I THOUGHT.

It seemed like every day another LAN was popping up on the horizon. And each one was just like the last. File servers, PC adapter cards, expensive cabling. All the things I wanted to get away from.

Then I took some advice from Avatar. And steered my efforts to ZEROSLOT LAN.

There's a PC network there that doesn't need a budget the size of Bulgaria or a consulting team to teach you how it works. It's Alliance ZSL.

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I've waited a long time for a network that makes this much sense. I didn't realize I was so close.

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5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

PC Magazine's Direct Marketing Connection

For PC Products and Services

For many of you, mail order is your primary means of purchasing PC products and services.

In fact, in recent interviews with our subscribers, we learned that 70% bought PC products and services through direct marketing channels during the past year.*

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The following special section, PC Magazine's Direct Marketing Connection, is what you've been demanding. It connects you with the direct marketers who are anxious to please you. By having them all in one place, you can quickly zero in on the products you need from the vendors you want to buy through.

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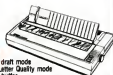


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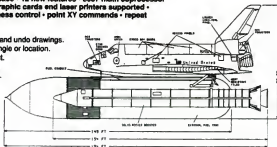


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*1986 Plan To Buy Study

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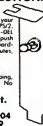
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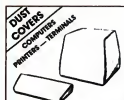
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COMING UP

DESKTOP PUBLISHING *PC Magazine's* page composition product experts Diane Burns and S. Venit review four sophisticated WYSIWYG page-making packages: Digital Research's *GEM Desktop Publisher*, Aldus's *PageMaker*, Laser Friendly's *The Office Publisher*, and Xerox's *Ventura Publisher*. It's a detailed look at the best PC-based desktop publishing software available enhanced by design tips, discussions of system configurations, and offerings of low-end and code-based software alternatives.

SCANNERS AND OCRs *PC Magazine's* reviewers investigate more than 30 scanners and optical character readers as well as the newest hand-held systems and add-on scanners that you mount on your printer's printhead. Ideal for desktop publishing applications, scanners and OCRs are experiencing a sudden surge in popularity. In the last year, the number of products on the market has tripled, and the OCR technology, in particular, has vastly improved with the introduction of scanners that can read proportionally spaced typeset material.

VOICE RECOGNITION Speaking replaces keystroking with this roundup of voice recognition devices. This technology enables your computer to turn spoken words into ASCII text files. Of course, no one voice recognition system on the market today can completely take the place of a stenographer, but these combination hardware/software products are significantly more advanced than those released even a year ago. Some of the newest systems can understand vocabularies of up to 1,000 words, recognize and record continuous speech, and distinguish the voices of several people interchangeably.

286 COMPUTERS Though the 386 is the machine of choice among PC speed freaks, the AT-class 80286-based computers are alive and doing well. The seven reviewed here—from ARC, FiveStar, Ind-Tech, Mitsubishi, PC Designs, Standard Brand, and Wang—offer low-priced, high-quality alternatives to the racier 386s.

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l. ☐ Communications
m. ☐ Accounting
n. ☐ Spreadsheets/Financial Planners

- o. ☐ Project Managers
p. ☐ Word Processors
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r. ☐ Graphics

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a. ☐ Administrative/General Management

- t. ☐ MIS/DP, Communications Systems, Programming
u. ☐ Engineering/R&D
v. ☐ Financial/Accounting
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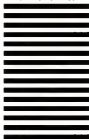
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AFTER HOURS



EDUCATION

Ticket to Paris: A Whirlwind Tour

BY GUS VENDITTO

Here's a learning game that leaves you hungry for more. And that's good, since a few rounds should prepare you for your first trip to la belle France.

Ticket to Paris is a simulation that tests your knowledge of French language and customs and, like a bad movie, throws in a chase scene whenever the action slows down. The lessons are limited to the simplest situations and phrases, but they make studying French somewhat more pleasant than repeating the dialogue on a language tape.

The game's graphics are fairly entertaining on CGA-equipped PCs, but they're a disappointment on EGA systems.

Your *Ticket* takes you to a handful of famous Parisian sites (Eiffel Tower, Louvre, Montmartre), and hands you the easily ignored task of finding a long-lost relative. Waiters and clerks present options at each destination to keep you moving.

As soon as the business of checking into a hotel, exchanging money, or ordering lunch is out of the way, you're confronted with a brief quiz on French history, culture, and language. It's multiple choice, and the choices keep recurring, so the questions become as familiar as those in *Trivial Pursuit* after a few sessions with the same deck. But because the game doesn't reveal the correct answer unless you pick it and the questions are intelligent, I was quickly hooked by the quiz. There are about 2,000 questions.

Once you've answered correctly a few times, clues abruptly appear, trying to interest you in that search they entrusted you with—there were too few clues



to distract me from the trivia quizzes.

Limited to a 65-word dictionary, and an itinerary of only 17 spots, *Ticket to Paris* most accurately simulates the first stop in a six-countries-in-five-days bargain tour. But for \$39.95, well, you weren't expecting a week at the Ritz, were you?

List Price: *Ticket to Paris*, \$39.95. **Requires:** DOS 2.0 or later; 128K RAM; CGA or EGA. Blue Lion Software Corp., P.O. Box 650, Belmont, MA 02178; (617) 876-2500.

CIRCLE 001 ON READER SERVICE CARD



GAMES

Cribbage Master Stands Ready to Play or Teach

BY CATHERINE D. MILLER

Cribbage is one of my favorite two-player card games, but I can't always find an opponent. As long as I'm near my PC, *Cribbage Master* is ready to challenge me to a rousing game.

There are three ways you can play: Solitaire, Duplicate, and Game Challenge. Game Challenge gives you an opportunity to play the master. You select the level of difficulty and decide

if you want *Cribbage Master* to score for you. This is where I found a great cribbage opponent.

Solitaire lets you go through one deck, the crib is always yours, and you try to beat 121 points. It's nearly impossible to win and, compared with Game Challenge, it's boring.

Not only is *Cribbage Master* a worthy opponent, it's also a great teacher. The on-line manual includes a section entitled "The Rules of Cribbage," which contains information about the game gleaned from ten expert sources. The crib, the play (which is not included in *Cribbage Master*), and scoring are discussed in detail. And two of the five play options are designed to turn even the most in-

experienced beginners into experts in a short time.

The Discard Master and Discard Query both help you improve your discarding skills. Choosing the best two cards to discard to the crib is probably the most important talent needed by cribbage mavens. In addition to keeping the best possible hand, you must consider whether the crib is yours or your opponent's.

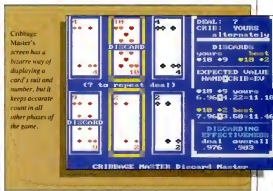
I especially liked the Discard Master as a learning tool. After you choose discards, the Discard Master tells you which are the best discards for your hand. You are given a discard effectiveness score from 0 to 1.0, with 1.0 being the most effective. Because you can choose whether you want the crib to always be yours, to always be your opponent's or to alternate between you and your opponent, you can work on improving specific discarding skills.

Discard Query lets you choose your hand. After you pick discards, it tells you which are the best and gives you an effectiveness rating.

About the only thing I missed was "pegging" on the cribbage board.

List Price: *Cribbage Master*, \$39.95. **Requires:** 128K RAM. Copy protected. Silversoft, 2150 Spruceway Ln., Ann Arbor, MI 48103; (313) 936-1106.

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AFTER HOURS



Top Guns: 4 Joysticks on the Job

BY MITT JONES

In a state of near-hypnotic concentration, your body pinned to the seat of an F-16 by the screaming force of matter-melting jet engines, you slice through the blue that separates you from a fleeing MIG. Suddenly, the MIG turns, banking dangerously back, and you frantically grope for the controls. Left Cursor, Up Cursor. . .

My favorite of the bunch is the CH Products Mach III. Though fairly small, the Mach III is sturdy and responsive, and I was able to eliminate drift with little effort. The lever is small enough to control easily but large enough not to cramp your fingers.

My second choice was the Gravis MKVI—the only joystick of the four with a pistol-grip lever. The MKVI is also the only one that lets you adjust the lever tension and interchange the functions of the three buttons.

The Kraft Systems Premium Joystick gives a snappy feel, and I prefer its button placement over that of the other three joy-

Palm Ave., Burnaby, B.C., Canada V5J 4M3; (800) 633-8558.

CIRCLE 606 ON READER SERVICE CARD

List Price: Kraft Systems Premium Joystick, \$49.95. **Requires:** Game port. Kraft Systems, 450 W. California Ave., Vista, CA 92083; (619) 724-7146.

CIRCLE 604 ON READER SERVICE CARD

List Price: Wico Computer Command, \$34.95. **Requires:** Game port. Wico Consumer Division, 6400 W. Gross Point Rd., Niles, IL 60068; (800) 323-4258.

CIRCLE 603 ON READER SERVICE CARD

2+4 EDUCATION

Mentor: Sharpening Your IQ

BY NEIL J. RUBENKING

Every day new programs appear, offering to unleash the powers of artificial intelligence. *Mentor* offers exercises designed to improve your own natural intelligence.

Mentor offers a barrage of tests for you to practice on. No records, no reports, no comparisons—the results are just for you. For example, in the Tone Memory test, the computer plays a short tone, then has you adjust another tone until it's the

same as the tone you remember. Another test involves counting objects that quickly flash onto the screen. There are as many as 20 or 30 objects, shown for just a few seconds. It surprised me, but with practice I was able to count that many.

In all, there are 13 psychometric tests under the headings Memory, Reaction, Coordination, and Perception. *Mentor* will also plot your biorhythm cycle, if you like.

The IQ test in the program is not the standard Stanford-Binet, but it works well on the computer. The questions do fall into categories, though, and it's possible to learn the trick to a whole category. Also, you can get the exact same test again. However, the author says he plans to add new data files.

People sometimes justify playing computer games with notions like "It's good for my hand-eye coordination" or "Solving the puzzles in these games helps me to be creative." But *Mentor* is made specifically for these purposes—no excuses required.

List Price: *Mentor*, \$49.95. **Requires:** 256K; DOS 2.1 or later; CGA or EGA. Copy protected. Heuristic Research Inc., Intelligence Architects, 3112-A W. Cuthbert Ave., Midland, TX 79701; (800) 443-7380; in Tex., (915) 694-5936.

CIRCLE 602 ON READER SERVICE CARD



Large joysticks are most appropriate for flight simulations; smaller handles work best with maze-based games.

If you limit your PC recreation to board games, text adventure games, or other genres that stress thought over action, it's easy to stay at one with your keyboard. But if more visceral pursuits relax you, you won't get far without a joystick. Action games such as *Flight Simulator*, *Jet*, and *Defender* are easier and much more fun with a joystick.

Of the four joysticks we tested, each has one button atop the lever and two on the base, each has switches that determine whether or not the lever bounces back to its neutral position, and each has trim adjustments to eliminate unwanted drifting.

sticks. But the lever is too thin—even for my relatively small hands. I also wasn't able to eliminate horizontal drift.

My least favorite of the four was the Wico Computer Command. There was too much play in the lever, making objects difficult to control.

List Price: Mach III Joystick, \$54.95. **Requires:** Game port. CH Products, 1225 Stone Dr., San Marcos, CA 92069; (619) 744-8546.

CIRCLE 606 ON READER SERVICE CARD

List Price: Gravis MKVI Analog Controller, \$54.95. **Requires:** Game port. Advanced Gravis Computer Technologies Ltd., 6894



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AFTER HOURS

SELF-ENRICHMENT

The Marriage Counselor: Software for the Rough Spots

BY BILL MACHROME

It's time to undo the damage. The PC has been blamed for too many strained marriages where one spouse sees nothing but the back of the other's head all evening. Can your computer help put things right? Too many of the supposed self-help programs are really games with the added gloss of some media star's smiling visage.

The Marriage Counselor rises above archness and game software by applying well-founded psychological principles to one of the most beleaguered institutions of our age. You and your spouse start by completing an on-screen questionnaire that covers age, previous marriages, number and ages of children, and other factors that could affect a relationship.

It then asks each spouse to agree or disagree with a large number of questions dealing with attitudes toward money, sex, children, aspects of your relationship, love and affection, and the way you spend time together. The sheer volume of

questions tends to break down resistance to the process.

As you might expect, *The Marriage Counselor* tallies your responses and offers helpful advice accordingly. But it goes beyond the expected by comparing your responses with a large base of responses from married couples. Rather than preaching right and wrong, it guides you to what is normal in a happy, healthy relationship.

My only quibbles with *The Marriage Counselor* were aesthetic. The questions are all in capital letters, a jarring counterpoint to the low-key, consultative nature of the product. You might object to the computer referring to itself as "I" in the consultative portion, but you can easily overlook such self-awareness once you become involved with the process.

The Marriage Counselor is a serious effort. As the blurb on the manual says, "If your marriage is good, this can make it better. If bad, it may save it." Get a copy for your favorite computerphile or computer widow and find out.

List Price: *The Marriage Counselor*, \$49.95. **Requires:** 256K RAM; monochrome or graphics monitor. Not copy protected. Human Perspectives Inc., 230 N. Pine St., Gardner, KS 66030; (800) 542-3466.

CIRCLE 688 ON READER SERVICE CARD



Ken Uston's Professional Blackjack's casino game accommodates up to seven players who can be controlled by the user or the computer.

GAMES

Professional Blackjack: Counting to Win

BY ROBERT BARNETT

Don't buy *Ken Uston's Professional Blackjack* if you're looking for a harmless, inexpensive way to enjoy the game of blackjack.

To Ken Uston, a professional gambler who proudly boasts of his banishment from a variety of casinos, blackjack isn't a game, it's a profit-loss situation. And this program, based on his methods, is a serious, rigorous tutorial chock-full of strategies designed for improving the odds in Atlantic City, Las Vegas, Monte Carlo, or any casino where they'll accept your money.

Professional Blackjack's manual presents four increasingly sophisticated systems for playing blackjack, starting with Basic Strategy, a table that will yield what Uston considers to be the best playing decision based on your hand and the dealer's up card.

Then, after mastering two intermediate systems, you can learn *The Uston Advanced Point Count*. In addition to hav-

ing Basic Strategy down cold, you must maintain a running card count with Uston's own point-counting method, estimate what percentage of playing cards has been used, and position your feet in one of eight positions to keep track of 24 aces in six-deck play. Uston has you use your feet so you don't have to mentally juggle both the ace count and the card count.

After learning each strategy from the instruction manual, you practice drills on the PC where random hands are dealt and you decide what course of action to take, getting beeped if you opt for a move contrary to what you learned. Finally, to put your new skills into practice, you can play an actual game, which will simulate the rules at a casino of your choice.

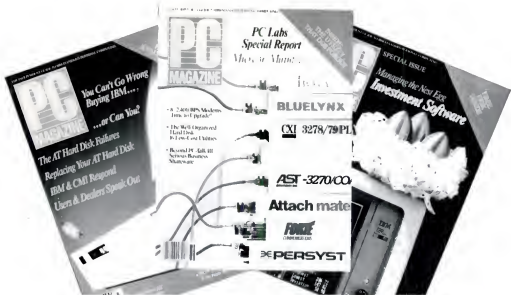
The elaborate strategies take time to learn, but the software and manual are lucid and friendly. What might dampen your interest in *Professional Blackjack*, though, is that it runs only on DOS 1.0 or 2.x; the manufacturer says the program's source code will be modified to accommodate DOS 3.x.

List Price: *Ken Uston's Professional Blackjack*, \$69.95. **Requires:** 128K RAM, DOS 1.0 or 2.x. *Brown Bag Software*, 2155 S. Bascom Ave., #114, Campbell, CA 95008; (408) 559-4545.

CIRCLE 687 ON READER SERVICE CARD



The Marriage Counselor uses an accepted psychological interview technique to analyze the attitudes of a couple.



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AFTER HOURS



PERSONAL FINANCE

Quicken, the Checkbook Manager, Does One Thing and Does It Well

BY BILL HOWARD

Most personal finance programs suffer from the Swiss Army knife syndrome. They try to do a little bit of everything: budgeting, financial planning, graphing, expense analysis, check writing, sometimes even figuring your personal net worth and household inventory. They wind up doing nothing very well, except gobbling up your time. While a finance program that puts your financial house in order would be worth an extra

finance program may well be the one with the fewest bells and whistles: Intuit's \$49.95 *Quicken*, which writes checks and balances your account. Period. *Quicken* is ideal for home PC users who write at least 20 checks a month and for small businesses that don't have an accounting program with a check-writing module.

The main screens resemble a blank check and a checkbook register. To write a check, you type in the payee and the amount. There's room for a five-line address and a 26-character memo. *Quick 'n* can memorize recurring checks, with or without fixed payments: type "cit", hit the F5 spelling-completion key, and *Quicken* fills in your \$332.16 monthly car payment to Citibank, the bank's address, and today's date.

You can get on-screen or printed reports of the entire register or of groups of items, such as every entry with the word "medical" in the memo line. You also can transfer everything or just selected items to 1-2-3 with a \$15 transfer utility.

Nice touches abound. *Quicken* doesn't care about a dollar sign or comma in an amount; most programs blanch if you type "\$3,595." To change the date, move to the date field and overwrite today's date, or hit the Plus or Minus keys to move a day at a time. You can post handwritten checks directly to the register.

Drawbacks? *Quicken* suffers from too many beeps and boops, with no way to turn off the audio. There's no safe, con-



Quicken's check-entry screen is a perfect analogue of a printed check. Enter the payment and Quicken spells it out automatically on the line below.

venient place to write your account number (department store, not bank) on checks. Put it on the memo field and you don't have much room for a useful memo; put it in the address area and anybody who looks at the window envelope has your MasterCard number.

Most users will find *Quicken* saves time and brings a modicum of sanity to bill-paying and check-writing. The more

checks you write, the more you'll find it a handy tool.

List Price: *Quicken*, \$49.95; checks, \$39.95 for 500; window envelopes, \$29.95 for 500; Lotus transfer utility, \$15. **Requires:** 192K RAM; DOS 2.0 or later; printer. Not copy protected. Intuit, 540 University Ave., # 50, Palo Alto, CA 94301; (800) 624-8742; in Calif., (800) 468-8481.

CIRCLE 669 ON READER SERVICE CARD

AFTER HOURS INDEX

QUICKEN

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hour or two a month, it's unlikely—no, impossible—that a computer can change human nature. If you're not already organized, don't look for salvation on a floppy disk.

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Picking Up the Correct Check

Before you figure out the cost of paying your bills with *Quicken* or some other check-printing program, factor in the cost of the checks.

Sticking a single check into a printer is impractical: the printer can't get a grip to properly push it through.

Checks printed on tractor-feed paper are available from Intuit or through most check printers (some banks will place the order for you). *Quicken* can be adjusted to print on any standard roll of checks. And banks will accept just about any reasonably sized check; all they want to see is an account number printed in MICR (magnetic ink characters).

At 8 cents per check and 6 cents per window envelope, it will cost several times what you pay for personal checks, but that's not out of line with what banks charge for business checks. If you buy your checks from a check printer, make sure you can get window envelopes of the proper size: it doesn't make sense to print your own checks and then have to address the envelopes separately.

—Bill Howard

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